W91-05959 -- W91-07117
CODEN: SWRABW

PB91-910207

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 24, NUMBER 7
JULY 1991

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 425, Reston, VA 22092. The **SWRA JOURNAL** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: Journal only, $170.00, Journal and Annual Indexes, $200.00; Indexes only, $80.00. Other Addresses, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 24, NUMBER 7
JULY 1991

W90-05959 -- W90-07117

The Secretary of the Interior has deterimined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 1991.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

CONSEQUENCES OF THE RECENT CLIMATIC VARIATIONS ON RIVER FLOW REGIMES IN WEST AFRICA.
Lagos Univ. (Nigeria). Dept. of Geography.
O. Ojo.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 251-262, 2 fig, 1 tab, 8 ref.

Descriptors: *Climatic changes, *Data analysis, *Developing countries, *Drought, *Hydrologic data, *Model studies, *River flow, *Streamflow forecasting, *West Africa, Data acquisition, Network design, Sahel region, Spatial variation, Temporal variation.

During the past 25 yr, climate in Africa has varied considerably. Particularly in West Africa, these variations have resulted in hydroclimatic events with serious consequences for man and his environment. Variability in temporal and spatial characteristics of the flow regimes of rivers (24 stations in the Sahel region and 36 stations outside the Sahel region) were examined with the aim of assessing the consequences of recent climatic variations and establishing some relationships between these variations and the river flow regimes. Both locational and regional variations, particularly with respect to river basins in West Africa, were used. The results show that much temporal and spatial variation characterizes the climatic events and their effects on river flow regimes in West Africa. These variations limit the representativeness of many of the existing climatic and hydroclimatic data and information for relatively large areas. The validity of the empirically determined data and information on flow regimes is considerably limited, particularly for the purpose of application of these data and information for research, planning, and development. There exists an urgent need to improve the acquisition of data and information on hydroclimatic characteristics in West Africa. The current, empirically determined relations may be valid within reasonable errors only for the locations for which they were derived. Three other issues of importance are (1) transfer and/or adaptation of efficient technology, (2) education and training; and (3) cooperation and coordination in solving hydrological problems. (See also W91-06461) (Rochester-PTT)
W91-06487

ESTIMATING WATER USE BY EUCALYPTUS GRANDIS WITH THE PENMAN-MONTEITH EQUATION.
South African Forestry Research Inst., Sabie.
For primary bibliographic entry see Field 2D.
W91-06541

EXTRAPOLATION OF RESEARCH RESULTS BY DETERMINISTIC MODELS.
Warsaw Univ. (Poland). Faculty of Geography and Regional Studies.
U. Soczynska.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 585-594, 7 fig, 1 tab, 11 ref.

Descriptors: *Forest hydrology, *Hydrologic models, *Kinematic wave theory, *Model studies, *Simulation analysis, *Streamflow forecasting, Canopy, Effective precipitation, Infiltration, Interception, Overland flow, Poland, Runoff, Soil moisture.

Traditionally, extrapolation of hydrological characteristics is connected with the indirect approach, using research results from the net of representative basins. An approach has been developed which allows direct simulation of hydrological precesses in ungaged catchments using a deterministic, distributed, physically-based model. This model was used to simulate the hydrological processes in a 15-sq-km basin in the Middle-Polish Lowland. Particular attention was given to interception by the four-layer plant canopy, effective rainfall simulation, infiltration, and overland flow. The one-dimensional component was tested by comparing measured and computed soil moisture profiles and the three-dimensional one by comparing the simulated and measured volumes of flow from the basin. Movement of the effective rainfall to the river bed as well as routing within the channel was described by kinematic wave equations for one-dimensional flow. The basin area was approximated by six planes, whereby computed overland flow from a plane occurs at the same time as inflow to a channel reach. Correlation between simulated and observed direct runoff hydrographs for a storm in June 1975 showed R=0.86. The accumulation of a large number of physiographic parameters and results permits one to establish a database of parameters representative of the physical environment as well as the hydrological season. (See also W91-06510) (Fish-PTT)
W91-06566

SPATIAL VARIABILITY OF OVERLAND FLOW IN A SMALL ARID BASIN.
Bar-Ilan Univ., Ramat Gan (Israel). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06724

2B. Precipitation

ERROR STRUCTURE OF MULTIPARAMETER RADAR AND SURFACE MEASUREMENTS OF RAINFALL. PART III: SPECIFIC DIFFERENTIAL PHASE.
Alabama Univ. in Huntsville.
V. Chandrasekar, V. N. Bringi, N. Balakrishnan, and D. S. Zrnic.
Journal of Atmospheric and Oceanic Technology JAOTES, Vol. 7, No. 5, p 621-629, October 1990. 5 fig, 36 ref, append.

Descriptors: *Error analysis, *Meteorology, *Radar, *Rainfall rate, *Remote sensing, Model studies, Rain, Reflectivity, Simulation models.

The error structure of the specific differential phase measurement in rainfall was investigated; this allows one to analyze three estimators of rainfall rate, the first based on the reflectivity factor, the second based on combining reflectivity and differential reflectivity, and the third based on specific differential phase alone. Simulations are used to model random errors in the three parameters. Physical variations in the raindrop size distribution are modeled by varying the gamma parameters over a range typically found in natural rainfall. Thus, the simulations in experiment incorporate physical fluctuations onto which random measurement errors have been superimposed. Radar-derived estimates using data obtained in convective rainfall were also compared. The range of applicability of the three rainfall rate estimators was determined. At intermediate rainfall rates between approximately 20 and 70 mm/h, simulations show that the estimator using the combination of reflectivity and differential reflectivity give the least error. However, there are other reasons that make the specific differential rate method useful: (1) its stability with respect to mixed phase precipitation, and (2) the fact that it is a differential phase measurement and thus insensitive to system gain calibration. This last premise suggests an accurate method of system gain calibration based on the rain medium. (Author's abstract)
W91-06110

NEW FAST RESPONSE INSTRUMENT FOR MEASURING TOTAL WATER CONTENT FROM AIRCRAFT.
Royal Aerospace Establishment, Farnborough (England).
For primary bibliographic entry see Field 7B.
W91-06111

METHOD FOR IMPROVING RAIN ESTIMATES FROM VERTICAL-INCIDENCE DOPPLER RADAR OBSERVATIONS.
Chicago Univ., IL. Lab. for Atmospheric Probing.
For primary bibliographic entry see Field 7B.
W91-06112

DEPENDENCE OF REFLECTIVITY FACTOR-RAINFALL RATE RELATIONSHIP ON POLARIZATION.
National Severe Storms Lab., Norman, OK.
D. S. Zrnic, and N. Balakrishnan.
Journal of Atmospheric and Oceanic Technology JAOTES, Vol. 7, No. 5, p 792-795, October 1990. 3 fig, 14 ref.

Descriptors: *Mathematical studies, *Meteorology, *Radar, *Rainfall rate, *Reflectivity, *Remote sensing, Error analysis, Polarization, Precipitation.

The reflectivity factor (Z), rainfall rate (R) relationship for weather radars that probe precipitation at low elevation angles is sensitive to polarization. A method has been developed to derive a formula that relates a reflectivity factor for orthogonal linear or circular polarization with a rain rate, provided that one such relationship and the polarization are known. The derivation and evidence from literature suggest that the familiar formula Z = 200 times R to the 1.6 power is correct for horizontal polarization. The results are simple and can be obtained by substitutions requiring minimal calculations. They imply that bias errors larger than 20% occur if a wrong polarization is used in the Z,R relation. Although there are several causes that contribute to the variability in rain rates that are estimated from single parameter Z,R relations, polarization should not be one of these because it is well understood and can be quantified. (Doria-PTT)
W91-06113

APPARENT GEOGRAPHIC AND ATMOSPHERIC INFLUENCES ON RAINDROP SIZES AND RAINFALL KINETIC ENERGY.
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
G. F. McIsaac.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 663-666, November/December 1990. 3 fig, 1 tab, 28 ref.

Descriptors: *Climatology, *Meteorology, *Rain, *Rainfall energy, *Rainfall impact, District of Columbia, Indonesia, Kinetic energy, Marshall Islands, New Jersey, North Carolina, Panama, Zimbabwe.

Rainfall kinetic energy was calculated from average drop size distributions measured at six locations. Median raindrop diameters in North Carolina, New Jersey, and the Marshall Islands tended to be less than those observed in Panama, Indonesia, Washington, D.C., and Zimbabwe. Calculated rainfall kinetic energies for Panama and Indonesia were within 10% of that predicted by the universal soil loss equation rainfall energy equation. Calculated rainfall energies for New Jersey, the Marshall Islands, and North Carolina ranged from 5% to 28% less than that predicted by the universal soil loss equation rainfall energy equation. An uncertainty interval of 15% to 30% of the estimated rainfall energy value is suggested to reflect uncertainties in geographic differences in raindrop sizes. Increasing the rainfall energy estimate by 7% for each 1000 m (3280 feet) of elevation above sea level is suggested to account for increased raindrop velocity under reduced atmospheric pressure. Additional research is recommended on the geographic efforts on raindrop sizes and raindrop detachment of soil, particularly in West Africa, at higher elevations and for periods exceeding 2 years. (Author's abstract)
W91-06235

RESPONSE OF MESQUITE TO NITRATE AND SALINITY IN A SIMULATED PHREATIC ENVIRONMENT: WATER USE, DRY MATTER

AND MINERAL NUTRIENT ACCUMULATION.
Oregon Graduate Center, Beaverton. Dept. of Environmental Science and Engineering.
W. M. Jarrell, and R. A. Virginia.
Plant and Soil PLSOA2, Vol. 125, No. 2, p 185-196, 1990. 5 fig, 7 tab, 36 ref.

Descriptors: *Mesquite, *Phreatophytes, *Plant growth, *Saline groundwater, *Salt tolerance, *Soil-water-plant relationships, *Water use efficiency, California, Desert plants, Dry matter, Leaves, Nitrates, Nitrogen, Nutrients, Roots, Sodium, Soil water.

Desert rivers or low-lying areas where groundwater accumulates are commonly populated with successful phreatophytes, often competing with agricultural or municipal users for water. Relatively few studies have been directed toward examining the environmental factors affecting the growth of these plants, or their effects on the soils in which they grow. Mesquite plants (Prosopis glandulosa var. Torreyana) were grown in soil columns, and provided with a constant, stable groundwater source, containing 0, 1, or 5 mM nitrate, or a mixed salt solution (1.4, 2.8, or 5.6 dS/m) with the ionic ratios of groundwater found in a field stand of Prosopis at Harper's Well (2.8 dS/m) in the western Sonoran Desert of California. Water uptake in the highly salinized columns began to decrease relative to low salt columns when soil salinity probes read approximately 28 dS/m, a potential threshold for mesquite salt tolerance. Prosopis growth increased with increasing nitrate, and decreased with increasing salinity. Water use efficiency was little-affected by treatment. Most fine roots were recovered from about 25 cm above the groundwater surface where water content and aeration appeared to be optimal for root growth. Root-shoot ratio was little-affected by nitrate, but increased slightly with increasing salinity. Plant tissue phosphorus concentrations tended to increase with increasing salinity and decrease with increasing nitrogen (N), approaching potentially deficient foliage concentrations at 5 mM nitrate. The whole-plant leaf samples increased in sodium concentration both with added salt and with added nitrate. Concentrations of sodium in leaves were low considering the high salt concentrations in the groundwater. Prosopis appears to exclude sodium very effectively, especially from its younger leaves. Although Prosopis is highly salt-tolerant, the degree to which it utilizes soil nitrate in place of biologically-fixed N may lower its salinity tolerance and affect its nutrient relations in phreatic environments. (Author's abstract)
W91-06312

PRECIPITATION PREDICTION OVER THE TROPICS FROM A GLOBAL SPECTRAL MODEL.
Florida State Univ., Tallahassee. Dept. of Meteorology.
T. N. Krishnamurti, H. S. Bedi, and D. K. Oosterhof.
Atmosfera ATMSEF, Vol. 3, No. 4, p 255-280, October 1990. 13 fig, 1 tab, 30 ref, 2 append. Florida State University NSF grant No. ATM-8812053 and NOAA Grant No. NA 87 AA-D-AC038.

Descriptors: *Climatology, *Meteorology, *Model studies, *Precipitation, *Satellite technology, *Tropical regions, *Weather forecasting, Africa, Atlantic Ocean, Climatic data, Convective precipitation, Hurricanes, Marine climates, Monsoons, Precipitation mapping, Rainfall, Regression analysis, Typhoons.

With the recent improvements in resolution, physical parameterization and data analysis techniques, global models are displaying considerable improvement of skill. The lack of observations has been a major factor for the lower skill over the Southern Hemisphere and especially over the tropics. The Florida State University (FSU) has developed a global spectral model capable of precipitation forecasting over the tropics. Monsoon rainfall was predicted by mapping the 'observed' distribution of rainfall using 1979 datasets. Over the oceanic areas the analysis is largely regression dependent and is found to underestimate the rainfall by as much as 100%. Evaporation over the tropical oceans was enhanced by the additional treatment of surface layer physics, deep convection, and initial analysis of the moisture field. The prediction of monsoon rainfall as a function of increasing resolution exhibited a major improvement in the position of the depression. An example of a precipitation forecast (up to about 5 or 6 days) from a very high resolution regional model (horizontal resolution of the order of 45 km) determined detailed hurricane rainbands in close agreement with the bands seen from satellite photographs. Results thus far have used the European Centre for Medium-range Weather Forecast (ECMWF) First GARP Global Experiment (FGGE) IIIb (gridded analyzed) database, and indicate that African easterly waves can be tracked across the Atlantic Ocean for 4 to 6-day periods. The best results of typhoon tracking forecasts came from the multilevel physical model at the highest resolution. There is a need to further increase the resolution of global models. (Fish-PTT)
W91-06404

MECHANISMS OF THE BLACK SEA CIRCULATION.
Sofia Univ. (Bulgaria). Dept. of Geophysics.
E. V. Stanev.
Earth Science Reviews ESREAV, Vol. 28, No. 4, p 285-319, 1990. 40 fig, 1 tab, 36 ref.

Descriptors: *Atmospheric circulation, *Black Sea, *Hydrologic models, *Marine climates, *Model studies, *Ocean circulation, Air circulation, Air-water interfaces, Eddies, Evaporation, Heat exchange, Kinetic energy, Precipitation, Wind.

Bryan's 1989 model was used in a study to simulate the circulation in the Black Sea. Wind stress, heat exchange, precipitation, and evaporation at sea surface were prescribed from climatic data. River inflow and the inflow from the Mediterranean Sea were taken from observations. Two types of models were examined: a general circulation model (GCM) with horizontal resolution delta lambda = 1 degree, delta phi = 0.5 degree and 12 levels; and an eddy general circulation model (EGCM) with horizontal resolution delta lambda = 20 minutes, delta phi = 10 minutes on the same levels. The GCM was designed to study the role of the wind and buoyancy fluxes for the establishment of circulation. Model data showed that in the baroclinic experiments kinetic energy was less than in the barotropic experiment. This was a consequence of the formation of a strong halocline in the upper layer, where a substantial part of the energy input transforms into potential energy. The specific vertical stratification in the Black Sea restricted the penetration of seasonal signal into deep layers, and preconditioned the establishment of a cold intermediate layer. Model data from the EGCM showed that eddies contribute to some change in the transport mechanisms, compared to those in the GCM. Seasonal forcing affected substantially the variability of the main Black Sea gyre. Comparisons between model and observational data indicated that models resolve the main features of the Black Sea circulation. They illustrated correctly physical processes in strong stratified geophysical fluids, and particularly in semi-enclosed basins, where precipitation and runoff exceeds evaporation. (Author's abstract)
W91-06410

CONSEQUENCES OF THE RECENT CLIMATIC VARIATIONS ON RIVER FLOW REGIMES IN WEST AFRICA.
Lagos Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W91-06487

SPATIAL AND TEMPORAL VARIATION OF RAINFALL AND RUNOFF IN HONG KONG.
Hong Kong Univ. Dept. of Civil Engineering.
A. W. Jayawardena, and M. R. Peart.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 409-418, 2 fig, 4 tab, 8 ref.

Descriptors: *Climates, *Data analysis, *Hong Kong, *Hydrologic data, *Model studies, *Rainfall, *Runoff, *Streamflow forecasting, Long-term studies, Network design, Spatial variation, Stream gages, Temporal variation.

Hong Kong lies in the tropics and experiences hot, humid summers that contrast markedly with the cool, dry winters. The incised topography is developed mainly upon predominantly volcanic and intrusive igneous rocks. Considerable spatial variation of the hydrologic variables can be seen in Hong Kong despite its small size. Maps of mean annual rainfall reveal spatial variation due to topography as well as to seasonal effects. It is possible to provide a simple measure of the spatial variation in rainfall by using the ratio of the highest to the lowest values recorded at any two gages in the network, with unity indicating no spatial variability. For the 22 gages having records for the period 1953-1982, the ratios for the months January through December are: 1.98, 2.00, 1.59, 1.68, 1.69, 1.90, 1.71, 1.66, 1.65, 1.69, 1.95, and 1.97, respectively. These ratios indicate that rainfall is most variable during the winter. For seven drainage basins, runoff data for 1981-1982 show that the maximum daily flow is recorded in the wet season for all basins, but that the day on which the maximum runoff is recorded varies among the basins. The spatial variation in the timing of maximum runoff may reflect the spatial differences in precipitation input. Temporal variation was analyzed using data from the Shek Pi Tau lowland stream gaging station (2792-hectare catchment). Runoff series (1965-1984) for this catchment and rainfall series (1946-1984) were analyzed for statistical properties and trends. Auto-regressive moving average (ARMA) models also were employed in analyzing the two time series. (See also W91-06461) (Rochester-PTT)
W91-06501

FROM THE PLOT TO THE WATERSHED: SCALE EFFECT IN THE AMAZONIAN FOREST ECOSYSTEM (DE LA PARCELLE AU PETIT BASSIN-VERSANT: EFFET D'ECHELLE DANS L'ECOSYSTEME FORESTIER AMAZONIEN).
Office de la Recherche Scientifique et Technique Outre-Mer, Cayenne (French Guiana).
J. M. Fritsch, P. L. Dubreuil, and J. M. Sarrailh.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 131-142, 5 fig, 2 tab, 7 ref. English summary.

Descriptors: *Forest hydrology, *Forest watersheds, *Rainfall-runoff relationships, *Scale factors, *Surface runoff, Amazon, Catchment areas, French Guiana, Geohydrologic units, Soil properties, Tropical regions.

Comparisons were made between surface runoff on a plot (400 sq m), on elementary drainage basins (0.15 sq km) and on a small drainage basin (4.5 sq km), all three on weathered shales and under tropical rain forest cover in French Guyana. Annual runoff on the plot was 8.8% of total rainfall in 1981, while small basin quickflow was 23%. The difference appears to result from soil properties. Elementary basin yield may be close to that of the plot or the small basin, depending on the evolutionary stage of the soil cover. There is evidence of hydrologic units which keep the regime independent of the size of the drainage basin. Thus, the variable source area concept is applicable in this region, for understanding scale effects. This methodology is attractive in a humid tropical environment because of its simplicity of use for an elementary basin, for which it would be laborious and time-consuming to continuously record the rainfall and water levels. (See also W91-06510) (Fish-PTT)
W91-06522

MODELLING FOREST TRANSPIRATION FROM CLIMATOLOGICAL DATA.
Groningen Rijksuniversiteit (Netherlands). Dept. of Physical Geography.
For primary bibliographic entry see Field 2D.

W91-06540

EXPERIMENTAL STUDY OF SLOPE FAILURE CAUSED BY HEAVY RAINFALL.
National Research Center for Disaster Prevention, Sakura (Japan).
For primary bibliographic entry see Field 2J.
W91-06583

CRITICAL RAINFALL (DANGER INDEX) FOR DISASTERS CAUSED BY DEBRIS FLOWS AND SLOPE FAILURES.
Kyoto Univ. (Japan).
For primary bibliographic entry see Field 2J.
W91-06593

EXPERIMENTAL STUDY ON THE PHENOMENA OF RAIN INFILTRATION.
National Research Center for Disaster Prevention, Sakura (Japan).
M. Tominaga.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 247-248. 1 fig, 3 ref.

Descriptors: *Erosion, *Infiltration, *Rainfall, *Rainfall infiltration, *Soil water, Dewatering, Groundwater movement, Rainfall intensity, Soil saturation, Surface erosion, Wetting.

Infiltration of rain is one of the most important factors influencing ground hazards such as slop failure and surface erosion. A series of experiments was conducted on rain infiltration to clarify its dynamic characteristics and to explore the relationship between rainfall pattern and the change with time of the soil water content. Characteristics of rain infiltration can be summarized as follows: rain water infiltrates into ground that is principally in an unsaturated condition; the surface of the ground is not always covered by water, and air in the soil is connected with the atmosphere through pores at the surface of the ground; the delivery of rainwater to the ground surface is not continuous; and, soil water content varies in response to changes in the intensity of rain. The wetting front moved downward at constant velocity under constant rain intensity. Capillary water appeared between the ground surface and the wetting front when rain is continued. Outflow of groundwater begins immediately after the wetting front reaches the capillary fringe. Changing patterns of rainfall intensity are transmitted to deep zones through the unsaturated soil-water zone after the wetting front reaches the capillary zone. Immediately after rain input ends, dewatering occurs for every position in the soil above the wetting front. (See also W91-06570) (Brunone-PTT)
W91-06598

CHEMISTRY OF ATMOSPHERIC PRECIPITATION AT THE WESTERN ARABIAN GULF COAST.
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
For primary bibliographic entry see Field 5C.
W91-06873

TESTS OF MODELS OF CLOUDWATER DEPOSITION TO FOREST CANOPIES USING ARTIFICIAL AND LIVING COLLECTORS.
Tennessee Valley Authority, Muscle Shoals, AL. Atmospheric Science Dept.
J. D. Joslin, S. F. Mueller, and M. H. Wolfe.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 3007-3019, 1990. 7 fig, 5 tab, 28 ref.

Descriptors: *Acid rain, *Cloud liquid water, *Cloudwater collectors, *Forests, *Model testing, *Path of pollutants, *Water sampling, *Wet deposition, Canopy, Model studies, Regression analysis, Spruce trees, Virginia, Wind velocity.

A passive string cloudwater collector, a small artificial tree, and a living Norway spruce were exposed to cloudwater on a raised platform at the summit of Whitetop Mountain, Virginia over a 5-month period. Collection rates by these three collectors were used to examine relationships between these rates and measured values for two important meteorological variables in models of cloudwater deposition to forest canopy, namely liquid water content and wind speed, the product of which is the horizontal cloudwater flux. Collection rates for all three collectors were predicted moderately well by horizontal cloudwater flux across all hours of observation, but were least strongly related when liquid water content was low. Collection efficiency was related to the logarithm of horizontal water flux, as predicted by the models, only when this relationship was analyzed within individual cloud events. Between individual cloud events, collection efficiency varied across a wide range with efficiencies much higher during events of short duration. Collection efficiency was often lower than predicted by models, possibly because the models do not take into account reductions in wind speed occurring within needle clusters on branches. Collection rates for all three collectors correlated highly with one another, as well as with a mature red spruce canopy. It is concluded that either the string collector or an artificial tree would serve as a good surrogate collector for living spruce tree crowns. (Author's abstract)
W91-06876

COMPOSITION OF BULK PRECIPITATION ON A COASTAL ISLAND WITH AGRICULTURE COMPARED TO AN URBAN REGION.
Vrije Univ., Amsterdam (Netherlands). Dept. of Meteorology.
E. P. Weijers, and H. F. Vugts.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 3021-3031, 1990. 5 fig, 5 tab, 16 ref.

Descriptors: *Acid rain, *Agriculture, *Chemistry of precipitation, *Coastal environment, *Islands, *Urban areas, *Water pollution sources, Acidity, Ammonia, Ammonium, Annual distribution, Calcium, Cattle, Chlorides, Ions, Magnesium, Nitrates, Nitrification, Potassium, Precipitation, Sodium, Statistical analysis, Sulfates, The Netherlands, Weather, Wind.

Results of chemical analyses of 15 years of monthly bulk samples from an island in the northern Netherlands are interpreted and compared with samples from a village near Amsterdam. Concentrations of ammonium, sulfate, and nitrate were higher in the island samples than in the village. Elevated ammonium concentrations were attributed to dry-deposited NH3 from cattle breeding, the only economic activity on the island. This trend is intensifying. Annual cycles and statistical computations indicate prior combinations of parts of ammonium and excess sulfate as ammonium sulfate. The nitrate content appears to be strongly related to ammonium. In the village data this correspondence is much weaker, whereas its pH values are systematically lower. It is therefore believed that nitrate concentrations on the island are increased by nitrification of ammonium in the collector. Annual cycles of sodium, magnesium, and chloride, and to a lesser extent potassium, are very similar (maximum November to January). The other annual patterns peak in the first half of the year: ammonium and excess sulfate in February, nitrate in June, potassium in January, and excess calcium in April. A combination of frequently occurring offshore winds and low precipitation amounts accounts for this behavior. (Author's abstract)
W91-06877

RELATIONSHIP BETWEEN PRECIPITATION AMOUNT AND WET DEPOSITION OF NITRATE AND AMMONIUM.
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5B.
W91-06879

EL NINO EFFECTS ON HYDROGEN ION CONCENTRATION OF A CALIFORNIA RESERVOIR.
California Univ., Berkeley. Kearney Foundation of Soil Science.
For primary bibliographic entry see Field 5B.
W91-06943

2C. Snow, Ice, and Frost

DEPOSITIONAL RECORD OF A GLACIAL-LAKE OUTBURST: GLACIAL LAKE SOURIS, NORTH DAKOTA.
National Highway Traffic Safety Administration, East Liberty, OH. Vehicle Research and Test Center.
For primary bibliographic entry see Field 2J.
W91-06411

LATE WISCONSIN ICEBERG-CALVING RATES AND ICE-SHEET MASS BALANCE RECONSTRUCTED FROM PALEO-SEA LEVELS, MOUNT DESERT ISLAND, MAINE.
Cincinnati Univ., OH. Dept. of Geology.
T. V. Lowell.
Geology GLGYBA, Vol. 19, No. 2, p 155-158, February 1991. 4 fig, 1 tab, 21 ref.

Descriptors: *Alaska, *Geologic history, *Glacier mass balance, *Glaciohydrology, *Icebergs, *Paleoclimatology, *Sea level, Floating ice, Ice breakup, Ice cover, Ice thickness, Moraines, Paleohydrology, Sea ice.

Ice sheets terminating in water may provide geologic evidence to reconstruct iceberg-calving rates and hence provide insight to ice-sheet mass balance at certain locations. Recent work reported an empirical relation for 12 modern tidewater glaciers in Alaska in which iceberg-calving rate is directly related to the average water depth. The former Laurentide ice sheet split into tidewater glaciers in the troughs of Mount Desert Island, Maine, and deposited moraine banks at sea level transgressed onto the island. Paleoshorelines were at least 65 m and probably as high as 90 m above present-day sea level. With 75 m shoreline elevation, the average water-depth values correspond to iceberg-calving rates of 650 to 2100 m/yr. The total ice-volume flux is equal to the rate of change in terminus position times the terminus area. Because the terminus is stationary when moraines are deposited, the calving flux is equal to the discharge flux at that time. Calculated discharge fluxes for Mount Desert Island range from 0.65 to 290,000 cu m/yr; the average is 170,000 cu m/yr across a unit width of the terminus. Consideration of the ice-sheet geometry and estimated precipitation and temperature conditions indicates that most of this flux must come from ice-sheet thinning rather than mass accumulation. The geometry of this analysis dictates that all of these estimates are minimum values. (Author's abstract)
W91-06412

PERMEABILITY OF FROZEN AND THAWED SOILS AND SUB-SOILS DURING SPRING SNOWMELT FLOOD.
Gosudarstvennyi Gidrologicheskii Inst., Valdai (USSR).
A. A. Kapotov.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 27-34, 3 ref.

Descriptors: *Frozen ground, *Infiltration, *Runoff, *Snowmelt, *Soil porosity, *Soil water, *Soviet Union, *Surface-groundwater relations, Flood forecasting, Seasonal distribution, Subsurface drainage.

The infiltration capacity of soils and subsoils in the basin of the Valdai Branch of the State Hydrological Institute (Soviet Union) is an important characteristic essential for computation and forecasting of meltwater runoff losses during the spring flood. Laboratory and field tests have been conducted to study the effects of various factors on this process. The main tasks undertaken were: (1) detailed investigations of the physical aspects of meltwater infiltration and the factors that determine water transporting and water absorbing capacity of frozen and

thawed soils; (2) establishment of integral indices of the water transporting capacity of soils and subsoils; (3) accounting for spatial irregularities in water absorption due to soil-landscape heterogeneity in river basins; and (4) evaluation of hydrometeorological and agro-meteorological factors and permanent landscape features of the basins to determine the conditions under which the extreme values of infiltration and percolation can be observed. Differences in the infiltration capacities of soils and subsoils of fields and forested basins in the zone of water surplus and adequate moistening explain differences in the formation of spring snowmelt runoff. In field basins composed of loams, during years of strong freezing of soils, the snowmelt runoff is formed mainly in the surface. When the depth of freezing is shallow, the groundwater component may be 50% of total river runoff. In forested basins, extent of soil freezing has practically no effect on the formation of river runoff. (See also W91-06461) (Rochester-PTT)
W91-06465

WATER RELEASE FROM A FORESTED SNOWPACK DURING RAINFALL.
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. Snow Hydrology Project.
R. Kattelmann.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 265-272, 2 tab, 23 ref.

Descriptors: *Flooding, *Forest hydrology, *Rainfall-runoff relationships, *Snowmelt, *Snowpack, California, Flood peak, Landslides, Snow depth, Snow sampling, Soil water.

The role of forest cover in rain-on-snow flooding is a major uncertainty in the forest hydrology of the Pacific Northwest. In areas of shallow to moderate snowcover, peak flows, landslides, and debris torrents have been attributed to storm periods involving snowmelt during rainfall. The frequency and magnitude of these damaging flows may be increasing due to timber harvesting. Snowpack water equivalent and snowpack outflow were monitored during several rain-on-snow events at a forest site and an adjacent open site in the Sierra Nevada of California. In all but two cases, the open snowpack lost more water than did the forest snowpack. The presence of a snowpack resulted in a delay of only a few hours from the onset of rain until water was released to the soil. There was little difference in delay between the forest and open sites. (See also W91-06510) (Fish-PTT)
W91-06535

FOREST HARVEST, SNOWMELT AND STREAMFLOW IN THE CENTRAL SIERRA NEVADA.
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 4A.
W91-06536

SNOW REDISTRIBUTION: STRIP CUTS AT YUBA PASS, CALIFORNIA.
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 4A.
W91-06537

EFFECTS OF FORESTS ON WETLAND RUNOFF DURING SPRING.
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06538

SPREADING OF OIL SPILLED UNDER ICE.
Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W91-07029

2D. Evaporation and Transpiration

DETERMINATION OF CRITICAL MOISTURE CONTENTS OF SOILS IN THE COURSE OF EVAPOTRANSPIRATION.
Slovenska Akademia Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky.
V. Novak.
Soviet Soil Science SSSCAE, Vol. 21, No. 4, p 122-126, 1989. 4 fig, 10 ref.

Descriptors: *Evapotranspiration, *Mathematical equations, *Soil moisture retention, *Soil water, *Soil-water-plant relationships, Soil properties.

Equations relating the relative evapotranspiration and moisture content of soil for three types of plants are derived from laboratory measurements. The critical moisture contents of the soil are determined as a function of potential evapotranspiration (Eo) rate and soil properties. The relationship between the relative evapotranspiration and the moisture content of the soil E/Eo = f(W) (where E is the actual evapotranspiration rate) may consist of three linear segments whose transition points are the critical moisture values W(k1) and W(k2). The critical moisture content W(k1) is proportional to the potential evapotranspiration and the critical moisture content W(k2) may as a first approximation be assumed constant (W(k2) = 0.67 W(3)). The slope of the plot E/Eo = f(W) will be between values of W(k2) and W(k1). (Author's abstract)
W91-05981

MEASUREMENT OF WATER USE AND PASTURE GROWTH ON TEMPLETON SILT LOAM.
Canterbury Agriculture and Science Centre, Lincoln (New Zealand).
For primary bibliographic entry see Field 2G.
W91-06307

EVAPORATION MEASUREMENTS BENEATH CORN, COTTON, AND SUNFLOWER CANOPIES.
Universidad de Extremadura, Badajoz (Spain). Dept. de Hortofruticultura.
F. J. Villalobos, and E. Fereres.
Agronomy Journal AGJOAT, Vol. 82, No. 6, p 1153-1159, November/December 1990. 7 fig, 3 tab, 31 ref.

Descriptors: *Crops, *Evaporation, *Evapotranspiration, *Soil water, *Soil-water-plant relationships, *Transpiration, Corn, Cotton, Hydrologic budget, Hydrologic models, Irrigation, Leaves, Lysimeters, Rainfall, Root zone, Spain, Water use.

In studies of crop-water relationship, it is important to separate soil water evaporation (E) from transpiration (T), particularly in studies of crop water use efficiency and in testing soil water balance models. Experiments were conducted at Cordoba (southern Spain) between 1986 and 1988 to obtain independent estimates of E from the soil and crop T in irrigated corn, cotton, and sunflower. Microlysimeters that allowed root exploration were used to estimate E by differential weighing. Cotton and sunflower evapotranspiration (ET) were measured with a weighing lysimeter (3 by 2 by 1.5 m), while corn ET was estimated using a water balance technique. Root density and soil water content inside the open microlysimeters were similar to those measured in the surrounding soil. Estimated E, when the soil surface was wet, varied from 80% of reference ET at 0.8 leaf area index (LAI) to 15% when LAI increased to four. A single relationship between E/ET(reference) and LAI fit the data for the three crops. The estimated E values for periods spanning 30 to 40 days, when LAI increased from 0.7 to 5, was 20 to 27% of measured ET, for an irrigation frequency of 7 to 8 days. The T values, calculated as the difference between ET and E, varied for a given LAI depending on the E level. When the soil surface was dry and E was low, the ratio T/ET(reference) in cotton was 1.1 for a LAI of three. If the surface soil was wetted by rain or irrigation, the calculated T/ET(reference) ratio dropped to 0.58 the first day after wetting. The results highlight the interdependence of the E and T processes in the consumptive use of water by row crops. (Author's abstract)
W91-06400

SIMPLE WATER-BALANCE MODELS FOR SIMULATING MOISTURE, SALINITY AND SODICITY PROFILES IN SOILS UNDER WHEAT.
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 3F.
W91-06418

CLASS A PAN EVAPORATION VERSUS POTENTIAL EVAPOTRANSPIRATION AT SEVEN LOCATIONS IN PUERTO RICO.
C. C. de Baez, and M. R. Goyal.
Journal of Agriculture of the University of Puerto Rico JAUPA8, Vol. 74, No. 3, p 343-346, July 1990. 2 tab, 7 ref.

Descriptors: *Evaporation rate, *Evapotranspiration, *Evapotranspiration potential, *Model studies, *Pan evaporation, *Puerto Rico, Climatic data, Correlation coefficient, Estimating equations, Hydrologic models, Regression analysis.

Several investigators have related estimated potential evapotranspiration (PET) with evaporation data to see if a model is suitable for a particular location. A study was performed to develop linear relationships among PET with various methods versus class A pan evaporation. Estimations and monthly class A pan evaporation at seven locations in Puerto Rico were used. Six PET models were used: Penman with albedo of 0.05, Penman with albedo of 0.23, Blaney-Criddle USDA-SCS, Blaney-Criddle modified by Shih, Blaney-Criddle modified by FAO, and Thornthwaite. Linear regression relationships were used to rank each PET model based on values of r. All regression coefficients and coefficients of correlation were significant at P=0.05 at all locations and for all models except at one site and for the Blaney-Criddle model modified by Shih. The Penman method gave the best estimate of PET. It is advisable to estimate PET with each model and determine a monthly PET range and average PET (sum of PET with each model divided by number of models). No single method is suitable for all locations. Selection of each method is based on the type of climatic data available. (Fish-PTT)
W91-06419

TRANSPIRATION OF MATURE STANDS OF SPRUCE (PICEA ABIES (L.) KARST.) AS ESTIMATED BY THE TREE-TRUNK HEAT BALANCE METHOD.
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Inst. of Forest Ecology.
J. Cermak, and J. Kucera.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 311-317, 3 fig, 2 tab, 10 ref.

Descriptors: *Analytical methods, *Forest hydrology, *Plant-water relationships, *Spruce trees, *Transpiration, Czechoslovakia, Drought effects, Heat balance, Hydrologic budget, Soil water.

Transpiration of fully-grown forest trees is an important part of stand or drainage basin water balance. Direct measurement of transpiration in variable terrain, representative enough for hydrological purposes, is not common. One of the most promising methods to obtain tree transpiration data is to measure the transpiration flow passing through tree trunks. The tree-trunk heat balance method for determining transpiration rate was applied to fully-grown spruce trees and stands in a hilly region of south Moravia. The maximum transpiration of a single tree was 130 L/day, and that of the entire spruce stand 45 mm/month. For the growing season the total transpiration was 180-280 mm, dependent on precipitation and soil moisture conditions. Dry soil caused the transpiration rate

to decrease, thus jeopardizing survival of the trees. The results obtained during long-term as well as short-term studies of tree transpiration show that hydrological and physiological behavior are closely correlated. (See also W91-06510) (Fish-PTT)
W91-06539

MODELLING FOREST TRANSPIRATION FROM CLIMATOLOGICAL DATA.
Groningen Rijksuniversiteit (Netherlands). Dept. of Physical Geography.
A. J. Dolman, and J. B. Stewart.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 319-327, 4 fig, 3 tab, 14 ref, append.

Descriptors: *Climatic data, *Forest hydrology, *Forest watersheds, *Hydrological models, *Model studies, *Plant-water relationships, *Transpiration, Conductance, Humidity, Hydrologic equation, Meteorological data, Soil moisture deficiency, Soil water.

Accurate prediction of the transpiration component of forests is of great importance in hydrological modeling of forested basins. The prediction of transpiration fluxes, however, is hampered by the lack of suitable models describing the interaction between transpiration and environmental variables. A method has been developed which yields hourly meteorological values from climatological data. These hourly data were used to predict hourly forest transpiration with the Penman Monteith equation and an elaborate submodel of surface conductance. Comparison with measured values showed good agreement. The need for soil moisture measurements was removed by using a simple water balance model. Estimates of soil moisture deficits and transpiration for an eleven-month period showed good agreement with measured values. A comparison with simpler models of surface conductance showed the need to include both soil moisture and humidity feedbacks in models of surface conductance. (See also W91-06510) (Author's abstract)
W91-06540

ESTIMATING WATER USE BY EUCALYPTUS GRANDIS WITH THE PENMAN-MONTEITH EQUATION.
South African Forestry Research Inst., Sabie.
P. J. Dye.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 329-337, 3 fig, 2 tab, 4 ref.

Descriptors: *Eucalyptus trees, *Forest hydrology, *Plant-water relationships, *South Africa, *Transpiration, *Water use, Canopy, Hydrological equation, Leaves, Meteorological data, Model studies, Penman equation, Sensitivity analysis, Stomatal transpiration.

A conflict exists in South Africa between the rising demands for both water and forest products from relatively small high rainfall regions. Detailed knowledge of transpiration from forest canopies is especially needed to predict the hydrological consequences of afforestation. The Penman-Monteith equation was used to estimate hourly transpiration from Eucalyptus grandis, the most widely planted hardwood species in South Africa. Micrometeorological data above the canopy were collected over one year, and supplemented by stomatal conductance and leaf area data. Daily water use was estimated on 11 days when canopy conductance was measured, as well as over 57 dry winter days when canopy conductance could be estimated from ambient vapor pressure deficit. Mean daily water use over this period was calculated to be 4.7 mm. A sensitivity analysis of the Penman-Monteith equation on a typical winter day suggested that hourly transpiration can be predicted from ambient humidity with a high degree of accuracy. (See also W91-06510) (Author's abstract)
W91-06541

SEASONAL VARIATION OF RADIATION AND ENERGY BALANCES IN A HINOKI STAND.
Forest and Forest Products Research Inst., Kyoto (Japan). Kansai Branch.
S. Hattori.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 349-355, 4 fig, 1 tab, 8 ref.

Descriptors: *Coniferous forests, *Energy, *Evapotranspiration, *Forest hydrology, *Forest watersheds, *Solar radiation, Bowen ratio, Canopy, Cedar trees, Heat storage, Japan, Water yield.

An estimate of forest evapotranspiration is necessary to understand the effects of forest treatments on the water yield of basins. In Japan, forest evapotranspiration has generally been estimated with the water balance method; micrometeorological methods have only been used in a limited number of cases. In addition, long-term observations of net radiation over forests are scarce, even though net radiation absorbed by forest is regarded as the primary energy source for evapotranspiration. The radiation and energy balances for 1980 over a 29-year-old hinoki cedar (Chamaecyparis obtusa) stand were measured. The total short-wave radiation received by the stand was partitioned as 10.7% reflected radiation, 58.4% for the net radiation, and minus 30.9% for the effective long-wave radiation on an annual basis. The evapotranspiration was calculated by the energy balance Bowen ratio method for 114 days between April and October under the dry canopy condition. Averaged over the period, the net radiation in daytime was utilized for the evapotranspiration of 45.8% and the sensible heat flux of 54.2%, and the heat storage in the soil was negligibly small compared with other components. (See also W91-06510) (Fish-PTT)
W91-06543

USE OF LYSIMETER MEASUREMENTS FOR ESTIMATION OF THE EVAPOTRANSPIRATION OF PINE FOREST BY BAGROV'S METHOD.
Humboldt-Univ. zu Berlin (German D.R.). Sektion Physik.
A. Helbig.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 357-363, 2 fig, 2 tab, 9 ref.

Descriptors: *Evapotranspiration, *Forest hydrology, *Hydrologic budget, *Lysimeters, *Pine trees, Annual precipitation, Evapotranspiration potential, Germany, Grasslands, Hydrologic equation, Rain gages, Rainfall-runoff relationships.

In order to ascertain the impact of a growing scotch pine forest (Pinus silvestris, 440 trees) on water balance, measurements were carried out near Magdeburg, Germany, during 1974-1985 using a nonweighing lysimeter (surface area 660 sq m, soil depth 4 m). The components of water balance runoff and precipitation were measured and yearly mean values of the evapotranspiration were estimated. It was found that with advancing years the evapotranspiration increased from 293.6 mm/year (3 years old) to 528.8 mm/year (14 years old). Simultaneously the evapotranspiration for grass vegetation were measured by means of 12 weighing lysimeters. Evapotranspiration for the forest was less than that for the grass up to the age of seven for the pine forest. Combined with the computation of the potential evapotranspiration after Turc/Ivanov, the 'effectiveness parameter' after Bagrov was estimated based on quotients of smoothed monthly sums of forest precipitation to potential evapotranspiration and forest evapotranspiration to potential evapotranspiration. Knowledge of these effectiveness parameter values allowed the calculation of yearly evapotranspiration sums of pine forests from precipitation and potential evapotranspiration data taking into consideration their age. (See also W91-06510) (Fish-PTT)
W91-06544

RATIOS OF EDDY TRANSFER COEFFICIENTS OVER THE AMAZON FOREST.
Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
Y. Viswanadham, L. D. De Abreu Sa, V. D. P. Silva Filho, and A. O. Manzi.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 365-373, 2 fig, 1 tab, 13 ref.

Descriptors: *Eddy diffusion, *Energy transfer, *Evapotranspiration, *Forest hydrology, *Hydrologic budget, *Rain forests, Amazon, Brazil, Heat flow, Hydrologic equation, Thermal energy, Water vapor.

Interpretations of results from a number of field experiments have established dimensionless forms for the flux-profile relationships and for the turbulence structure as functions of thermal stability. These formulations provide a working basis for further studies in forest meteorology and other allied fields. A study was made to determine ratios of eddy transfer coefficients based on simultaneous measurements of the vertical turbulent fluxes and vertical profiles above the Amazon tropical rain forest in Brazil. Simultaneous profile and eddy flux data gathered over the Amazon forest have been analyzed to find values of the nondimensional profile gradients (phi values) and vertical eddy diffusivity constants (K values) for momentum, heat, and water vapor. The ratio of the K value for heat to that for momentum and to that for water vapor were obtained from phi functions. The phi functions and ratios of eddy diffusivities were evaluated over a stability range of $-1.0 < Ri < 0.25$ (Ri = Richardson number). The results showed: (1) in quasi-neutral conditions ($-0.03 < Ri < 0.03$), the inferred value of the phi value for momentum was 1.28 (+/-0.13), that for heat was 0.53 (+/-0.25), and that for water vapor was 0.45 (+/-0.15); (2) the ratios of the K values for heat to momentum, water vapor to momentum, and heat to water vapor were greater than unity in unstable, near neutral, and slightly stable conditions; and (3) the ratio for heat to water vapor was less than unity for $Ri > 0.04$. Turbulent transport processes can account for the anomalies in K values. (See also W91-06510) (Author's abstract)
W91-06545

2E. Streamflow and Runoff

DISSOLVED ORGANIC CARBON DYNAMICS IN A SMALL STREAM.
Bucknell Univ., Lewisburg, PA. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W91-06009

SUMMER FEEDING PATTERNS OF WHITE PERCH, CHANNEL CATFISH, AND YELLOW PERCH IN THE SUSQUEHANNA RIVER, MARYLAND.
Versar, Inc., Columbia, MD.
For primary bibliographic entry see Field 2H.
W91-06010

EFFECTS OF VARYING CURRENT ON WEIGHT LOSS FROM WILLOW LEAF PACKS.
Chadwick and Associates, Littleton, CO.
For primary bibliographic entry see Field 2H.
W91-06011

FISH ASSOCIATIONS AND ENVIRONMENTAL VARIABLES IN AGE-0 COLORADO SQUAWFISH HABITATS, GREEN RIVER, UTAH.
Fish and Wildlife Service, Vernal, UT.
For primary bibliographic entry see Field 2H.
W91-06013

SIMPLE SYSTEM OF REPLICATED RECIRCULATING EXPERIMENTAL STREAMS.
Oklahoma Univ., Kingston. Biological Station.
For primary bibliographic entry see Field 2H.
W91-06014

MACROINVERTEBRATE COMMUNITIES ASSOCIATED WITH THREE AQUATIC MACROPHYTES (CERTOPHYLLUM DEMERSUM, MYRIOPHYLLUM SPICATUM, AND VALLISNERIA AMERICANA) IN LAKE ONALASKA, WISCONSIN.
National Fisheries Research Center, La Crosse, WI.
For primary bibliographic entry see Field 2H.
W91-06016

DIFFERENTIAL COLONIZATION AND GROWTH OF ALGAE AND FERROMANGANESE-DEPOSITING BACTERIA IN A MOUNTAIN STREAM.
Middlebury Coll., VT. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W91-06018

CURRENT DISTRIBUTION AND STATUS OF THE UPPER CUMBERLAND RIVER JOHNNY DARTER, ETHEOSTOMA NIGRUM SUSANAE.
Tennessee Cooperative Fishery Research Unit, Cookeville.
For primary bibliographic entry see Field 2H.
W91-06019

SEASONAL VARIATIONS IN BACTERIAL COMMUNITIES IN ADIRONDACK STREAMS EXHIBITING PH GRADIENTS.
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W91-06022

HYDRODYNAMIC AND FLUVIAL MORPHOLOGIC PROCESSES: IMPLICATIONS FOR FISHERIES MANAGEMENT AND RESEARCH.
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
B. H. Heede, and J. N. Rinne.
North American Journal of Fisheries Management NAJMDP, Vol. 10, No.3, p 249-268, Summer 1990. 6 fig, 106 ref.

Descriptors: *Aquatic habitats, *Channel morphology, *Fish management, *Fisheries, *Stream improvement, *Stream morphology, Sediment transport, Stream fisheries, Streambeds.

The disciplines of hydrology, fluvial morphology, and fisheries science have, for the most part, developed separately. However, the functioning and interactions of stream hydrology and morphology dictate the habitat and its quality for fish. Some hydromorphological parameters appear to be more relevant in determining fish habitat than others, in part perhaps because of the current level of understanding between them. Nevertheless, all factors interact to produce conditions either beneficial or detrimental to fish. Streamflow, sediment transport, and channel morphology are all examples of important factors influencing fish habitat. The designation of whether changes in stream habitat have either positive or negative effects on fishes is life stage dependent. Further, the more hydraulic and geomorphologic factors considered relative to the various fish life stages, the greater is the information content, reliability, and applicability of results. Habitat improvement designs can affect the project results. For instance, neglect of the existence of knickpoints downstream from a planned habitat enhancement (i.e., installation of structures) could lead to failure of the project due to undercutting by the upstream progression of the knickpoints. Characteristics of fish habitat must be modified with great care, and then only if (1) the causes for an undesirable condition are known; and (2) the modifications will be compatible with future stream development. In such an evaluation of fish habitat, the inclusion of hydrodynamic and fluvial morphologic variables should provide more precise quantification of habitat characteristics. (Author's abstract)
W91-06026

ROLE OF REFUGIA IN THE RECOLONIZATION OF STREAMS DEVASTATED BY THE 1980 ERUPTION OF MOUNT ST. HELENS.
Utah State Univ., Logan. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 2H.
W91-06034

SYSTEMATIC POLLUTEGRAPH SIMULATION FOR REAL SCALE RIVER BASIN.
Yamaguchi Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W91-06054

INFLUENCE OF VARIOUS EXPOSURE PERIODS ON THE BIOMASS AND CHLOROPHYLL A OF CLADOPHORA GLOMERATA (CHLOROPHYTA).
Northern Arizona Univ., Flagstaff. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W91-06248

EFFECTS OF SUBSTRATE RELIEF ON THE DISTRIBUTION OF PERIPHYTON IN LABORATORY STREAMS. I. HYDROLOGY.
Oregon State Univ., Corvallis. Dept. of Botany and Plant Pathology.
D. M. DeNicola, and C. D. McIntire.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 624-633, 1990. 5 fig, 8 tab, 57 ref. U.S.D.I. Geological Survey grant BSR-8318386.

Descriptors: *Algae, *Algal growth, *Flow velocity, *Periphyton, *Stream biota, *Streams, Aquatic habitats, Biomass, Chlorophyta, Epilithon, Habitats, Streambeds, Streamflow, Substrates.

The hypothesis that the heterogeneity of epilithic algal assemblages in streams may be partly a result of hydrologic differences created when water flows over a rough substrate was examined. A 32-day experiment was conducted in laboratory streams that contained either 22.5 by 22.5 by 4 cm or 7.5 by 22.5 by 4 cm tile blocks. Free-water velocities in the streams averaged 28 cm/second. Hydrologic parameters and algal assemblages associated with surfaces on top of blocks and with recessed surfaces between blocks were compared to corresponding surfaces in streams with no relief. In streams with blocks, shear velocities averaged 1.7 cm/second on the top of blocks and 0.8 cm/second in the recessed areas. Shear velocity averaged 1.7 cm/second on the top of blocks and 0.8 cm/second in the recessed areas. Shear velocity at corresponding surfaces in the control (no relief) streams averaged 1.9 cm/second and exhibited little variation. The hydrologic differences created by the larger blocks significantly affected the distribution of algal biomass, with recessed areas giving an average of 2.6 g/square ash-free dry weight more biomass than surfaces on the top of blocks. Differences in shear velocities and biomass accumulation between top and recessed areas for the smaller blocks were less than for large blocks. Successional changes on all substrates were similar with the exception that recessed surfaces had a significantly greater abundance of the filamentous chlorophyte Stigeoclonium tenue (Ag.) Kutz. after day 16. The results suggest that in cobble riffle areas of natural streams, the interactions between current flow and substrate relief have the potential to create patches of algae which are different in biomass and taxonomic composition. (See also W91-06255) (Author's abstract)
W91-06254

EFFECTS OF SUBSTRATE RELIEF ON THE DISTRIBUTION OF PERIPHYTON IN LABORATORY STREAMS. II. INTERACTIONS WITH IRRADIANCE.
Oregon State Univ., Corvallis. Dept. of Botany and Plant Pathology.
D. M. DeNicola, and C. D. McIntire.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 634-641, 1990. 5 fig, 2 tab, 53 ref. U.S.D.I. Geological Survey grant BSR-8318386.

Descriptors: *Algae, *Algal growth, *Light effects, *Light intensity, *Periphyton, *Stream biota, Aquatic life, Biomass, Light, Light penetration, Radiation, Species diversity, Streambeds, Streamflow, Substrates.

Laboratory streams were used in a 42-day experiment designed to investigate how the spatial and temporal distribution of lotic periphyton created by current flow over cobble-size substrates is affected by irradiance. The streams contained 22.5 by 22.5 by 4 cm substrate blocks and were exposed to either 385, 90 or 20 microE/square m/second. Periphyton succession in fast current regimes on top of blocks and in slower current regimes on surfaces recessed between blocks were monitored. The absolute differences in ash-free dry weight algal biomass between top and recessed substrates were significantly affected by irradiance and time. At the end of the experiment, biomass in streams exposed to 385 microE/square m/second was approximately 2 times greater than in streams exposed to 90 microE/square m/second and 8 times greater than streams exposed to 20 microE/square m/second. Differences in biomass were greater between irradiance levels than between top and recessed substrates within an irradiance level. Irradiance also had a greater effect than current regime on the taxonomic composition of assemblages. Oscillatoria agardhii Gomont and Navicula minima Grun. characterized assemblages at 20 microE/square m/second, whereas Fragilaria vaucheriae (Kutz), Nitzschia oregona Sov., Navicula arvensis Hust. and Stigeoclonium tenue (Ag.) Kutz. were more abundant at the two higher irradiances. Detrended correspondence analysis indicated that the rate of succession was relatively high for assemblages at high irradiance and in the slow current regimes between blocks. The results suggested that in natural streams, periphyton patches produced by large differences in irradiance should have a greater effect on periphyton heterogeneity than substrate-induced patches. Moreover, the heterogeneity of algal patches produced by hydrologic differences over a substrate is constrained by irradiance level. (See also W91-06254) (Author's abstract)
W91-06255

PHYSICOCHEMICAL FACTORS AFFECTING THE ABUNDANCE AND SPECIES RICHNESS OF FISHES IN THE CIMARRON RIVER.
Oklahoma Water Resources Board, Oklahoma City. Water Quality Div.
For primary bibliographic entry see Field 2H.
W91-06278

SELECTIVE SORTING AND ABRASION OF RIVER GRAVEL: I. THEORY.
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 2J.
W91-06290

SELECTIVE SORTING AND ABRASION OF RIVER GRAVEL: II. APPLICATIONS.
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
G. Parker.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 150-171, February 1991. 15 fig, 2 tab, 16 ref.

Descriptors: *Abrasion, *Alluvial channels, *Bed load, *Gravel, *Particle size, *Sediment sorting, *Sediment transport, *Sedimentology, Alberta, Canada, Case studies, Limestone, Quartz, Red Deer River, River basins, Rock properties, Sediment grading, Tectonics.

Most gravel rivers show a tendency for characteristic grain size to decrease in the downstream direction over scales of tens or hundreds of kilometers. It has been surmised that this downstream fining is due to some combination of selective sorting, by which finer grains are preferentially transported downstream; and abrasion, by which individual particles are reduced in size. A framework for the simultaneous treatment of both phenomena has been developed and used to analyze several cases of interest. In particular, wavelike aggradational profiles of permanent form were

considered. An application to the Red Deer River in Alberta, Canada, as well as several hypothetical cases, suggests the following result. In the case of quartzite, selective sorting controls downstream fining; in the case of limestone, abrasion and selective sorting are of roughly equal importance; and in the case of a mixture of quartz and limestone, abrasion ceases to be important beyond some characteristic length scale required to grind the gravel-sized limestone out of existence. (See also W91-06290) (Author's abstract)
W91-06291

SUSPENDED SEDIMENT-TRANSPORT CAPACITY FOR OPEN CHANNEL FLOW.
West Virginia Univ., Morgantown. Dept. of Mechanical and Aerospace Engineering.
For primary bibliographic entry see Field 2J.
W91-06293

FIRST-ORDER ANALYSIS OF OPEN-CHANNEL FLOW.
Polytechnic Univ., Brooklyn, NY.
For primary bibliographic entry see Field 8B.
W91-06297

RATES OF SOIL CHEMICAL CHANGES WITH ELEVEN ANNUAL APPLICATIONS OF CATTLE FEEDLOT MANURE.
Agriculture Canada, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 5B.
W91-06408

FRIENDS IN HYDROLOGY.
Proceedings of an International Conference held at Bolkesjo, Norway, April 1-6, 1989. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. 491p. Edited by Lars Roald, Kjell Nordseth and Karin Anker Hassel.

Descriptors: *Conferences, *Data analysis, *Experimental basins, *Hydrologic data, *Hydrology, *Model studies, *Streamflow forecasting, Cooperation, Data acquisition, FREND project, Floods, Low flow, Norway, Runoff, Technology transfer.

International collaboration in hydrological projects allows a variety of analytical techniques to be applied to large regional data sets not confined by national boundaries. The scientific value is enhanced if these data sets include high-quality measurements from experimental and research basins. The FREND (Flow Regimes from Experimental and Network Data) project was initiated by the Institute of Hydrology (Wallingford, U.K.) and proposed and accepted as a contribution to Project 6.1 in UNESCO's International Hydrological Programme-III for 1985-1988. The FRIENDS (Flow Regimes from International Experimental and Network Data Sets) Conference, held in April 1989 at Bolkesjo, Norway, marks the conclusion of the FREND project, an example of practical cooperation involving 13 European countries. The present volume contains the proceedings from the FRIENDS Conference, including contributions on hydrologic techniques, regional analysis, human impact studies, managing international research programs, hydrologic modeling, data acquisition, data processing, statistics, and low-flow and high-flow analysis and prediction. (See W91-06462 thru W91-06509) (Rochester-PTT)
W91-06461

FREND (FLOW REGIMES FROM EXPERIMENTAL AND NETWORK DATA): THE FIRST ONE HUNDRED DAYS.
Institute of Hydrology, Wallingford (England).
A. Gustard.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p xiii-xxii, 5 fig, 3 tab, 5 ref.

Descriptors: *Data analysis, *Europe, *FREND project, *Hydrologic data, *Hydrology, *Model studies, *Streamflow, *Streamflow forecasting, *United Nations, Experimental basins, Network design, Rainfall, Soil moisture.

The FREND (Flow Regimes from Experimental and Network Data) project is part of UNESCO's Third International Hydrological Programme. The study area covers Great Britain, Scandinavia, and much of western Europe. The several objectives of the FREND project were to: develop a data base of river flow and rainfall data; to apply existing methods and to develop new methods for estimating extreme events at ungaged sites; to apply consistent methods for analysis to a number of small research basins; to use models developed at small research watersheds for evaluating the impact of human influences, including impacts on soil moisture regime and water table; and to carry out a literature survey of the most important human influences. One of the tasks of the first 100 days of the FREND project was to select and collect data from a large number of agencies in northern and western Europe. This data collection effort covers a wide range of data types and involves over 40 European agencies. Despite length of records limitations in some localities, inadequate distribution of stations, and inconsistency among catchment characteristics, the current data base is a valuable research resource for the tasks of describing the temporal and spatial distribution of floods and low flows, and for developing new techniques for analyzing research basin data and studying human influences. To fulfill one of the initial objectives of the project, the river flow, rainfall, and single-value catchment characteristic indices have been made generally available for use in future research. (See also W91-06461) (Rochester-PTT)
W91-06462

REVIEW ON THE SMALL HYDROLOGICAL BASINS IN FINLAND.
Environmental Protection Service, Jerusalem (Israel).
P. Seuna.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 3-12, 4 fig, 43 ref.

Descriptors: *Catchment areas, *Data analysis, *Experimental basins, *FREND project, *Finland, *Hydrologic data, *Model studies, *Streamflow forecasting, *Watersheds, Europe, Hydrologic models, Network design.

Research in small hydrological research catchments in Finland began with the establishment in 1929 of a network of 32 basins by the National Board of Agriculture. In a reorganization during the period 1957-1962, all but four of the original basins were retained in a new system of research basins. By 1987 there were 60 basins. The data obtained from these basins has been employed in four ways: (1) direct transposition of observations to an ungaged basin; (2) development and use of design models and nomographs; (3) control basin studies for land use changes; and (4) process studies. The data obtained from the Finnish network has been employed in the first phase of the FREND (Flow Regimes from Experimental and Network Data) project, which is part of UNESCO's Third International Hydrological Programme. The FREND project incorporates data from other countries in northern and western Europe. (See also W91-06461) (Rochester-PTT)
W91-06463

OPTIMAL FILTERING TECHNIQUES IN FLOOD FORECASTING.
Sri Lanka Univ., Peradeniya. Hydraulics Lab.
G. E. Amirthanathan.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 13-25, 9 fig, 5 tab, 9 ref.

Descriptors: *Data analysis, *Data processing, *Flood forecasting, *France, *Hydrologic data, *Hydrologic models, *Model studies, *Streamflow forecasting, ARMAX model, Basse Seine, Filtering, Mathematical models, Prediction.

Optimal filtering techniques based on Kalman filtering, with adaptations, have been used widely in hydrology. Some optimal filtering techniques for flood forecasting were applied to a data set from Basse Seine in France with the aim of evaluating the merit of the filtering techniques. Comparative performance of the ARMAX (AutoRegressive Moving Average with exogenous inputs) model with adaptive filtering and a deterministic model were analyzed for some steps-ahead flood forecasts. Various adaptive filtering techniques for forecasting floods at Seine at Melun were compared with two constraints: (1) flood events of short duration and (2) relatively high level of measurement noise. The quality of the optimal filter is conditioned by the precision of the estimate of R and Q (error statistics) were tested, but the results differed little. The recursive least squares (RLS) method gave equally good results in one-day-ahead forecasts. This may be due to sensitivity of initial values, especially for flood events of short duration. The method of considering discharges as state variables did not give notable improvements. As R was very close to 0, the results were almost identical to those obtained with the RLS method. For the same reason, the method using two filters (MISP Technique) gave very little improvement. The instrumental variable method (IV and AML), which is very efficient with a high noise level, gave similar results because noise was almost white and the events were of short duration. This method is very effective for data of longer duration. A deterministic method based on the Saint Venant equation was applied to the same data. The adaptive method gave better one-day-ahead forecasts, but the performance became almost the same for two and three days ahead forecasts. For forecasts more than one day ahead, deviation increases due to uncertainties in tributary inflows are common in both methods. (See also W91-06461) (Rochester-PTT)
W91-06464

PERMEABILITY OF FROZEN AND THAWED SOILS AND SUB-SOILS DURING SPRING SNOWMELT FLOOD.
Gosudarstvennyi Gidrologicheskii Inst., Valdai (USSR).
For primary bibliographic entry see Field 2C.
W91-06465

ROLE OF INSTRUMENT TYPE AND ERRORS IN THE CONSTRUCTION OF CATCHMENT WATER BALANCES.
Ulster Univ. at Jordanstown, Newtownabbey (Northern Ireland). Dept. of Computing Science.
C. Essery.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 35-46, 5 fig, 2 tab, 18 ref.

Descriptors: *Catchment areas, *Data analysis, *Experimental basins, *Hydrologic budget, *Hydrologic data, *Instrumentation, *Measuring instruments, *Model studies, *Streamflow forecasting, Errors, Runoff, Soil water, Statistics, Surface-groundwater relations.

Water balances are a common method used to establish the quantitative estimates of the hydrological components within river catchments. Despite their popularity, little work has been done on the effects of instrumentation and the associated errors on the overall conclusions of water balance statements. The major components of surface water balance were measured independently in this study. Estimates of precipitation were derived from ground level, turf wall, and standard rain gages, whereas evapotranspiration estimates were derived from Penman data and directly from irrigated lysimeters and evaporation tanks. The aim was to establish which (if any) combination of instrumentation provides the best agreement between the residuals of the surface water balance (precipitation-discharge-evapotranspiration) and the observed fluctuations of groundwater storage. Simple correlation and linear regression analysis were used to compare inferred storage changes in groundwater storage. Correlations are highest on a

monthly water balance basis despite the apparent complication of autocorrelation between consecutive months. The combination of instruments that yields the best agreement between inferred and actual storage changes appears to be one based on ground level rainfall, Penman PE, and stream discharge. The exclusion of systematic soil moisture measurements originally was thought to be the main deficiency in the field data. The effects of soil moisture and surface depression storage may, however, be deduced from the nature of the regression relationship between the surface water balance residuals and the groundwater storage fluctuations. (See also W91-06461) (Author's abstract)
W91-06466

APPLICATION OF THE WEST GERMAN IHP RECOMMENDATIONS FOR THE ANALYSIS OF DATA FROM SMALL RESEARCH BASINS.
Freiburg Univ. (Germany, F.R.). Inst. fuer Physische Geographie.
S. Demuth.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 47-60, 3 fig, 2 tab, 22 ref.

Descriptors: *Data analysis, *Germany, *Hydrograph analysis, *Hydrologic data, *Hydrological models, *International hydrological decade, *Model studies, *Streamflow, *Streamflow forecasting, Base flow, Experimental basins, Performance evaluation, Standards.

From the Federal Republic of Germany International Hydrological Decade recommendations, two different methods of hydrograph analysis, base flow and recession analysis, were selected and the performance of these methods was evaluated. The application of the results was assessed in a multiple regression model was assessed using data from the FREND (Flow Regimes from Experimental and Network Data) project area (Europe). The base flow method is limited to basins with sustained flows, whereas in the recession analysis a simple exponential model was applied and the master recession curve was obtained by simple arithmetic averaging of the recession parameters. The method was biased toward the more short, steep recessions, so a more robust model was developed using a shifting procedure to reposition the recession limbs. Relationships were established using a multiple regression model. The model used base flow and recession constant as predictors and morphometric characteristics and a climatic parameter as independent variables. Besides the effect of standardizing the base flow, the role of the base flow index (BFI) and the time on the regression model were investigated. This application of two hydrograph analysis procedures on an international data set is a successful step toward using small research basins in regional hydrology. The modified base flow estimation procedure gave good results in those catchments representing low flow regimes. In flashy catchments with low storage capacity the method was not applicable. (See also W91-06461) (Rochester-PTT)
W91-06467

RIVERFLOW PREDICTION DURING BASEFLOW RECESSION ON SOME BRITISH HARD ROCK CATCHMENTS.
Loughborough Univ. of Technology (England). Dept. of Civil Engineering.
A. Owoade, and M. D. Bako.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 61-65, 4 fig, 2 tab, 7 ref.

Descriptors: *Base flow, *Data analysis, *Great Britain, *Hydrologic data, *Hydrologic models, *Model studies, *River flow, *Streamflow forecasting, Catchment areas, Errors, Management planning, Mathematical models, Prediction, Surface-groundwater relations.

Several techniques/models available for prediction of baseflow have been devised. A graphical method was developed for separating residual flows during baseflow analysis. The method was applied to 377 recession periods on nine British hard-rock catchments prior to the derivation of baseflow recession constants for these catchments. The main objective of the study was to assess the accuracy of flows predicted during baseflow recession using the exponential decay model. The prediction errors were calculated for time units varying from 1-21 days. For time units of 1-4 days, prediction errors were between 4% and 8%, whereas for time units of 5-12 days the errors averaged about 15%. Beyond 12 days, the predicted flows were significantly in error, with deviations reaching 34% for a 17-day prediction. The results presented here are intended as a guide for water resources managers on what error margins to incorporate in planning or management decisions based on predicted recession flows, such as in river regulation or pollution control. (See also W91-06461) (Author's abstract)
W91-06468

USE OF THE FLOW RECESSION CURVE FOR THE ESTIMATION OF CONDITIONS OF RIVER SUPPLY BY UNDERGROUND WATER.
Akademia Rolnicza, Wroclaw (Poland). Inst. of Hydro- and Geotechnics.
L. Radczuk, and O. Szarska.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 67-74, 12 ref.

Descriptors: *Base flow, *Data analysis, *Hydrographs, *Hydrologic data, *Model studies, *Poland, *Recession, *Streamflow forecasting, *Surface-groundwater relations, Errors, Geohydrology, Low flow, Regional studies, River Odra, Runoff, Statistics.

The estimation of runoff from a drainage basin and the character and quantity of river supply from groundwater can be made on the basis of drainage basin observations including the phenomenon of rainfall-runoff relationships. The method of basin hydrogeological regionalization proposed by Pozniak in 1975 helps in the evaluation of the quantity of river supply from groundwater as well as the unit groundwater flow in a hydrodynamic formulation. Based on this approach, a method was devised for defining the recession curve. The method was applied to data from the River Odra basin, Poland. The main hydrological characteristics defining the water reserves in the river basin are mean flow, precipitation, and retention capacity. The highest correlation observed in the present study was the relation of baseflow with discharge, for which the R-squared was 0.5-0.77, depending on the river reach. The recession curves defined by this method can be used for solving such hydrogeologic problems as forecasting of low water flows, separation of groundwater from the hydrograph, and evaluation of active groundwater resources. Comparing the unit flows with the flows resulting from annual and from long-term recession curves in different sections shows clearly that the hypothesis of the 'River Odra's water escape' to the groundwater zone is not confirmed. (See also W91-06461) (Rochester-PTT)
W91-06469

COMPUTER-AIDED ANALYSIS OF FLOW RECESSIONS AND COUPLED BASIN WATER BALANCE INVESTIGATIONS.
Technische Univ., Dresden (German D.R.). Dept. of Water Sciences.
R. Schwarze, U. Grunewald, A. Becker, and W. Fruhlich.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 75-83, 2 fig, 5 ref.

Descriptors: *Computer programs, *Data analysis, *Germany, *Hydrographs, *Hydrologic data, *Model studies, *Recession, *Streamflow forecasting, *Surface-groundwater relations, Base flow, DIFGA computer program, Experimental basins, Groundwater flow, Nitrogen, Seasonal variation.

Information on the origin of river basin discharge, particularly the proportion of different discharge components comprising the seasonal variation, is very important for various purposes in hydrology and water management. A computerized technique and the program DIFGA, developed at the Dresden University of Technology, can be used to continuously separate lengthy time series of recorded daily discharges into flow components and to investigate and evaluate the water balance of the basin on a monthly basis. The application of this technique has proved to be useful for analyzing the seasonal distribution of flow into its main components, the overall water balance of the river basins under consideration, and the chemical composition of the water in relation to the considered flow components. The technique was tested in more than 30 test basins with areas between 0.5 and 300 sq km. As an example, results form the Saidenbach basin (area 54.7 sq km) for the period 1968-1983 show that amounts and ratios of runoff in winter are significantly higher than in summer. During summer direct flow exceeds base flow (unlike winter). Other research has shown that, for the period 1975-1984, the nitrate-N concentration clearly was related to the delayed long-term base flow component but not to the total discharge. This observation underscores the significance of investigating flow components in connection with water quality studies. The most critical assumption of the present technique, the approximation of the discharge behavior of groundwater systems (short-term base flow and long-term base flow) by that of a linear reservoir, has been proved to be acceptable. It was found, however, that the application of more complicated and complex models (e.g., of nonlinear reservoirs) did not yield significant improvements. (See also W91-06461) (Rochester-PTT)
W91-06470

ANALYSIS OF TIME VARIABILITY IN RECESSIONS.
Oslo Univ. (Norway). Dept. of Geography.
L. Tallaksen.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 85-96, 1 fig, 5 tab, 23 ref.

Descriptors: *Data analysis, *Hydrographs, *Hydrologic data, *Hydrologic models, *Model studies, *Norway, *Recession, *Streamflow, *Streamflow forecasting, Base flow index, Low flow, Mathematical equations, Mathematical models, Precipitation, Regression analysis, Temperature, Temporal variation.

It is generally accepted that it is necessary to include a numerical expression for the storage properties of a catchment in a low-flow study. In Norway the recession constant commonly has been used for this purpose. However, individual recession segments show great variability within a catchment. The present study examined the natural causes of this variation by incorporating data on precipitation and temperature during the recession period. The recession constant was included in a low flow regression model to investigate the possibilities of improving the accuracy of the estimation equations. The results were compared with an earlier study in which a different expression of storage properties, the Base Flow Index (BFI), was included in the same type of low-flow regression model. No significant relationship could be found between temperature and recession values using statistical techniques. Similarly, the recession values could not be related to geomorphological characteristics. A further approach is to model the catchment system as a way of assessing vertical water budget. This provides a more realistic estimate for water losses during recession periods. Inclusion of a recession constant in a low-flow model increases the estimation accuracy of all the recession equations. The same effect was achieved by incorporating the BFI. The regression constant is preferable when the low flow indices are standardized by mean annual runoff and the BFI is preferable when they are standardized by area. Both analyses demonstrate the need for incorporating an expression for storage properties. (See also W91-06461) (Rochester-PTT)
W91-06471

FITTING DISTRIBUTIONS TO ANNUAL MINIMUM FLOWS OF DIFFERENT DURATIONS.
Institute of Hydrology, Wallingford (England).
M. Polarski.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 97-104, 4 fig, 5 ref.

Descriptors: *Data analysis, *Hydrologic data, *Minimum flow, *Model studies, *Scotland, *Statistics, *Streamflow forecasting, Errors, Flood frequency, Performance evaluation, Streamflow, Weibull distribution.

Probability distributions of annual minimum flows are required for a number of water resources applications. These include estimating the availability of water for effluent dilution and for domestic, industrial, and agricultural abstractions. To respond to this range of design problems, it often is necessary to derive these distributions for flows of different durations. In doing so it is necessary to ensure that estimated quantiles of long durations exceed those of short durations. Due to sampling errors this is not necessarily achieved when the fits are performed individually for each duration. A method was developed for fitting a three-parameter Weibull distribution to annual minimum flows that complies with this constraint and remains as close as possible to the maximum likelihood estimations provided by individual fits. The method is illustrated using data for the River Findhorn at Shenachie, Scotland. Daily mean flows are available for this station for the period 1960-1984 (25 yr). The method described here could be developed and applied to a wide range of practical problems where it is necessary to maintain consistency between different, but related, frequency curves. These include flood flows of different durations, depth-duration-frequency analysis for rainfall design, and reservoir storage-yield relationships. Further work is needed in evaluating the precision of the estimations and in selecting a suitable range of durations to use. (See also W91-06461) (Rochester-PTT)
W91-06472

CONSISTENT SCALE PARAMETER FOR HYDROLOGICAL STUDIES.
Universite Nationale du Benin, Cotonou. Dept. de Mathematiques.
A. Afouda.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 107-118, 2 tab, 6 ref.

Descriptors: *Arid regions, *Data analysis, *Hydrologic budget, *Hydrologic data, *Hydrologic models, *Model studies, *Semiarid lands, *Streamflow forecasting, Evaporation, Latent heat, Mathematical models, Scale factors, Spatial distribution, Temporal distribution.

An understanding of the temporal and spatial distribution of hydrologic variables is crucial in arid and semiarid regions. Based on the general observation that water and heat balances of a land surface are strongly coupled through evaporation-latent heat equivalence, a description of the complex system formed by the global water cycle and the energy transfer is considered through conduction and turbulent processes. The invariance properties of this model also were investigated. The symmetry transformations that leave the action function invariant depend crucially on a scale parameter that has been shown to be related to the parameter identified previously by Lorenz and by May. (See also W91-06461) (Rochester-PTT)
W91-06473

ANALYSIS AND APPLICATION OF EXPERIMENTAL AND NETWORK DATA FOR DEFINING HYDROLOGIC CHARACTERISTICS OF UPSTREAM FORESTED WATERSHEDS.
Taiwan Forestry Research Inst., Taipei. Watershed Management Div.
J. D. Cheng, V. T. Liu, S. W. Lee, and C. C. Koh.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 119-128, 5 fig, 6 tab, 14 ref.

Descriptors: *Data analysis, *Forest watersheds, *Hydrologic data, *Hydrology, *Model studies, *Streamflow forecasting, *Taiwan, Experimental basins, Network design, Runoff, Seasonal distribution, Streamflow, Te Chi Reservoir.

An integrated approach utilizing relevant physiographic and hydrometeorological information was employed to describe and demonstrate the hydrologic characteristics of forested watersheds tributary to the Te Chi Reservoir in central Taiwan. Despite having shallow soils and steep slopes, the study watersheds appear to have large capacities for influencing the water yield production and the streamflow regimes during intense torrential storms in the May-October typhoon season, possibly due mainly to each having good forest cover and heavy undergrowth and a thick forest floor humus layer. Variations of annual and monthly streamflows are relr d closely to those of rainfalls. The study area wate sheds are correlated closely for most streamflow parameters, indicating similar hydrologic environments. Therefore, roving short-term hydrometric stations can be used together with relevant data from long-term network stations to better define and estimate hydrologic characteristics of watersheds of various sizes in a relatively large geographic area. Experimental watershed data are particularly useful in gaining some insight into hydrologic processes such as flow generation mechanisms and flow regimes of small watersheds. (See also W91-06461) (Author's abstract)
W91-06474

PREDICTION OF HYDROLOGICAL SIMILARITY IN THE HUNTER VALLEY, AUSTRALIA.
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
B. G. Cook, P. Laut, M. P. Austin, D. N. Body, and D. P. Faith.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 129-136, 4 fig, 8 ref.

Descriptors: *Australia, *Data analysis, *Hydrologic data, *Model studies, *Runoff, *Streamflow, *Streamflow forecasting, Network design, Rainfall, Regression analysis, Statistics, Stream gages.

Indices of streamflow, rainfall, and landscape were defined for a set of gaged basins in the Hunter Valley, Australia, and multiple regression equations were developed that relate the indices of streamflow to those of rainfall and landscape. Application of the regression equations to the population of meso-scale basins in the valley allows the basins to be classified into hydrological similarity groups. The classification was used to examine the adequacy of the stream gaging network in the valley. A population of non-nested basins in the Hunter and Karuah valleys was selected. It included 213 basins having areas in the range 10-270 sq km. (The population was chosen independently of 29 ungauged basins under consideration.) Each of the four 1931-1980 50-yr rainfall indices R1 to R4, for the basins of the population was estimated by fitting a splined surface to the index values of the forty-six 50-yr rainfall stations using functions of latitude and longitude and, for R1 and R2, elevation. An estimated index value for each grid cell within a basin was read from the surface and the basin average calculated. The landscape indices for the basins of the population were determined by locating each basin in the landscape space at the weighted centroid of the positions of the grid-cell groups contained within it. Values of the 1931-1980 streamflow indices for each basin were estimated using four regression equations representing observed vs predicted streamflow indices for the 29 ungaged basins. This procedure located the basins of the population in 4-dimensional streamflow space. Twenty-six streamflow similarity groups within this space were defined using a Euclidean distance measure and a sequential, agglomerative, hierarchical, non-overlapping classification procedure. It is hypothesized that proximity in the streamflow space indicates similarity in hydrologic behavior and that this behavior may be inferred from gauged basins in the same neighborhood of the space. (See also W91-06461) (Rochester-PTT)
W91-06475

ASPECTS OF HYDROLOGICAL INTERPOLATION WITH THE HELP OF GIS.
Hydroconsult A.B., Uppsala (Sweden).
I. Krasovsskaia, and L. Gottschalk.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 137-145, 4 fig, 8 ref.

Descriptors: *Data analysis, *Geographic information systems, *Hydrologic data, *Hydrologic data collections, *Model studies, *Streamflow forecasting, *Sweden, Data acquisition, Data processing, Hydrology, Lake Hjalmaren, Mapping, Network design, Runoff, Satellite technology.

During the last decade, geographic information systems (GIS) have become an important potential source of information for hydrologic applications. The problem of the adequacy of traditional hydrologic observational data for GIS applications was addressed using a GIS application developed and tested for the basin of Lake Hjalmaren, Sweden. The system employs digitized map data, satellite data, and point observation data. The basic units in the system are sub-basins of a main basin 50-100 sq km in area. The system was used to calculate hydrologic characteristics for each sub-basin, employing a number of interpolation methods. Adequacy of the results of such interpolations based on the existing hydrologic and climatologic observation nets is doubtful. The existing networks in Sweden do not appear to cover mesoscale variability. The regional regression equations used for interpolation were developed for catchments of the 20 to 2000 sq km area. However, these equations do not consider the mesoscale physiographic variability, which is connected to that of runoff as was shown by the field study. Inductive methods, ie, direct measurements of runoff, must be used for proper interpolation to mesoscale. To be able to use the information offered by GIS when interpolating runoff to mesoscale, the traditional hydrological observations, which provide time series for a point, should be complemented by synchronous hydrological measurements at many points in space. Future hydrologic applications of GIS call for a more flexible attitude concerning what constitutes hydrologic sampling in time and space. (See also W91-06461) (Rochester-PTT)
W91-06476

CHARACTERIZATION OF WATERSHEDS BY THE INTEGRATION OF REMOTE SENSING AND CARTOGRAPHIC DIGITAL DATA.
Faculte des Sciences Agronomiques de l'Etat, Gembloux (Belgium). Lab. de Teledetection et d'Hydraulique Agricole.
A. Mokadem, J. O. Motta, and S. Dautrebande.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 147-152, 4 fig, 6 ref.

Descriptors: *Belgium, *Catchment areas, *Data analysis, *Geographic information systems, *Hydrologic data, *Hydrologic models, *Mapping, *Model studies, *Remote sensing, *Streamflow forecasting, Land use, Mathematical models, Satellite technology, Simulation, Soils, Spatial variation, Vegetation.

The different modeling techniques employed in hydrology require information concerning various features of watersheds: type of soil, physical and hydric soil properties, slope, land use, type of vegetation cover, etc. All these parameters, components of conceptual hydrologic models, exhibit spatial variability regarding watersheds. Manipulating these data in digitized form makes the model easier to use and makes it possible for its sensitivity to any spatial or temporal modification of watershed features to be checked. Small watersheds in Belgium were spatially characterized by the inte-

gration of cartographic and remote sensing data. The hydrological model SWRRB (Simulator for Water Resources in Rural Basins) was tested. The results obtained with this model are quite satisfactory for small watersheds, especially considering that the model was not adapted or adjusted for the flows studied. The present study demonstrated the importance of creating a data bank in the form of a geographic information systems (GIS) prior to using a hydrologic model. GIS-type data have the distinct advantage of enabling algorithms, developed for processing numerical images obtained by earth observation satellites, to be applied to the majority of spatial parameters. (See also W91-06461) (Rochester-PTT)
W91-06477

HYDROLOGY OF MOUNTAINOUS AREAS: SCIENTIFIC PROBLEM AND A FIELD OF INTERNATIONALLY COORDINATED RESEARCH.
Slovenska Akademia Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky.
L. Molnar, and P. Miklanek.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 153-161, 6 ref.

Descriptors: *Data analysis, *Europe, *Hydrologic budget, *Hydrologic data, *Hydrology, *Model studies, *Mountains, *Spatial variation, *Streamflow forecasting, Evapotranspiration, Mathematical equations, Precipitation, Runoff, Stream gages, Water storage.

Mountainous areas, with their specific features, remain one of the most important sources of fresh and high-quality water on earth. However, the steep slopes of mountains with variable soil conditions and vegetation create a rather complicated system to be fully described and mathematically modeled. Areal heterogeneity of runoff in these areas is related to several factors, including: rough terrain and high elevation, orientation and steepness of basin slopes, vegetation cover, soil profile characteristics, and geologic structure. Development realistic water balance equation for mountainous areas requires that the special conditions for the single components of (1) precipitation, (2) runoff, (3) evapotranspiration, and (4) water storage in mountainous areas be taken into consideration. The higher proportion of snow in precipitation, as well as the effect of high winds, contribute to making precipitation measurements in mountainous areas inaccurate. Traditional stream-gaging methods fail to provide information on subsurface flow in alluvium and stream-alluvium interactions, two characteristics of runoff in mountain streams. Numerous factors contribute to the complexity of making accurate determinations of evapotranspiration in mountainous areas. Water storage in the mountainous basin, including deep seepage, is practically unmeasurable. Cooperative programs have been undertaken at both the Central and Eastern European and global levels to study the hydrology of mountain areas. (See also W91-06461) (Rochester-PTT)
W91-06478

APPLICATION OF REGIONAL FLOOD FREQUENCY ANALYSIS TO BASINS IN NORTH-WEST EUROPE.
Institute of Hydrology, Wallingford (England).
L. A. Roald.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 163-173, 6 fig, 3 tab, 14 ref.

Descriptors: *Catchment areas, *Data analysis, *Europe, *Flood frequency, *Hydrologic data, *Model studies, *Streamflow forecasting, Base flow index, Cluster analysis, Land use, Precipitation, Regional analysis, Statistics.

Methods for identifying homogeneous groups of basins in terms of their flood frequency distributions were applied to 1597 series from basins in northwest Europe (13 countries). Cluster analysis based on a data space defined by flood statistics was able to identify homogeneous groups, but the group membership could not be identified uniquely for each site based on catchment characteristics. Use of an alternative definition of the data space based on catchment characteristics resulted in groups that were not homogeneous in terms of the frequency distribution. Catchment characteristics employed in the analysis were basin area, shortest distance to sea, altitude of station, slope of main stream, EFS stream density index, forest fraction, urban fraction, weighted lake index, soil index, base flow index, average annual precipitation, and rainfall intensity. Better results were obtained by dividing the data set into subsets containing geographic regions according to the general flood regime prior to cluster and discriminant analysis. Groups defined from cluster analysis based on basin characteristics will not define homogeneous groups unless the analysis is limited to geographic regions consisting of one regime. (See also W91-06461) (Rochester-PTT)
W91-06479

REGIONS ARE DEAD; LONG LIVE THE REGIONS: METHODS OF IDENTIFYING AND DISPENSING WITH REGIONS FOR FLOOD FREQUENCY ANALYSIS.
Institute of Hydrology, Wallingford (England).
M. Acreman, and S. Wiltshire.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 175-188, 7 fig, 3 tab, 22 ref.

Descriptors: *Data analysis, *England, *Flood frequency, *Hydrologic data, *Model studies, *Regional analysis, *Streamflow forecasting, *Ungaged basins, Hydrologic models, Mathematical models, Prediction, Regression analysis.

In traditional approaches to regional flood frequency analysis, the study area is divided into disjoint regions and a dimensionless flood frequency relationship is derived separately for each. Flood quantiles for ungaged or poorly gaged drainage basins may be estimated by assigning the basin to its appropriate region. 'Regions' may be contiguous geographical areas of land or areas of a space defined by the physical characteristics of gaged basins. To avoid discontinuities in flood estimates across regional boundaries and to allow for basins that cannot be unambiguously assigned to one region. If such fractional membership is permitted it can be argued that there is no longer any need to have a priori regions. Each basin can constitute its own region and flood frequency estimates for ungaged sites can be calculated directly from a number of similar or nearby basins. The contribution from each site is weighted by a measure of the physical similarity between them, such as the inverse distance between the basins in physical characteristic space. The major problem to be overcome is defining the relative importance of different physical characteristics when deriving the weights. Results of regression analysis and sensitivity analysis using a stochastic rainfall model in tandem with a deterministic rainfall-runoff model were examined as a way to help resolve this problem. Although use of a regression model directly for flood estimation has disadvantages, it provides useful insight into the relative influence of different basin characteristics on flood frequency. An alternative method is to calculate weights using a rainfall-runoff model. Such a model has been developed for Farnborough (southeast England). Running the model with a 1000-yr sequence of simulated hourly rainfalls using the optimum parameter set for the River Mole provided a baseline flow sequence. To fully utilize the results of this type of analysis on ungaged sites, relationships must be developed between model parameters and physical characteristics of the basins (e.g., soil type) that can be measured on maps. (See also W91-06461) (Rochester-PTT)
W91-06480

APPLICATIONS OF REGIONAL FLOOD FREQUENCY PROCEDURES IN IRELAND.
Irish National Committee for IHP, c/o Office of Public Works, Dublin.
T. Bree, J. Curran, and C. Cunnane.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 189-197, 6 fig, 10 ref.

Descriptors: *Data analysis, *Flood frequency, *Hydrologic data, *Ireland, *Model studies, *Regional analysis, *Streamflow forecasting, *Ungaged basins, Prediction, Runoff, Unit hydrographs.

The basic principles of regional flood frequency analysis currently in use in Ireland are those contained in the Natural Environment Research Council's (NERC)1975 Flood Studies Report. Two contrasting methods for ungaged catchments are included in the report's recommendations: (1) Method A, based on statistical flood frequency analysis and predicting the mean annual flood from catchment characteristics and use of region curve coordinates (flood peak of return period T in cu m/sec divided by mean annual flood) and (2) Method B, founded on rainfall frequency analysis and a rainfall-runoff unit hydrograph/losses procedure, which uses the design storm and unit hydrograph model as published by NERC. Without modification Method A agrees more closely with floods estimated from observed annual maximum flood data than Method B, which tends to overestimate. Modifications have been developed for local conditions that take account of arterial drainage effects and the availability of unit hydrograph and percentage runoff data. (See also W91-06461) (Author's abstract)
W91-06481

APPLICATION OF GIUH AND DIMENSIONLESS HYDROGRAPH MODELS TO UNGAGED BASINS.
Warsaw Univ. (Poland). Faculty of Geography and Regional Studies.
B. Nowicka, and U. Soczynska.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 197-203, 3 fig, 10 ref.

Descriptors: *Data analysis, *Flood peak, *Hydrologic data, *Hydrologic models, *Model studies, *Poland, *Streamflow forecasting, *Ungaged basins, *Unit hydrographs, Carpathian Mountains, Floods, Geographic instantaneous unit hydrograph, Lososina River, Mathematical models, Performance evaluation, Rainfall intensity, Sola River.

In the Geographical Instantaneous Unit Hydrograph (GIUH) approach, the instantaneous unit hydrograph (IUH) is derived as a function of the basin's geomorphological and physiographic characteristics and is interpreted as the probability density function of the travel time for a drop of water landing anywhere in the basin. The dimensionless hydrograph (DH) model depends on determination of two parameters (peak flow and the concentration time), which may be computed on the basis of physical basin characteristics and effective rainfall intensity. The calibration of models was conducted in two basins in the western Carpathian mountains (Poland): Sola River basin at Rajcza cross section and Lososina River basin at Jakubkowice cross section. In the Sola River basin the errors in peak flow estimation with the GIUH and DH methods were, respectively, 54% and 28%; the relationship of the computed peak flow to those observed were 1.54 and 1.28, respectively, for the two methods. The accuracy of peak flow occurrence calculation with the DH model is connected strictly to the temporal distribution of effective rainfall. The basis of the hydrograph determination is the mean value of effective rainfall intensity. The results of overland flow simulation in the Lososina River basin were good. Error in the peak flow estimation was 13.5% with GIUH and 6% with DH. Relations of the peak flows computed to those observed were 0.86 and 0.94, respectively. (See also W91-06461) (Rochester-PTT)
W91-06482

LOW FLOW REGIMES OF NORTHERN AND WESTERN EUROPE.
Institute of Hydrology, Wallingford (England).

A. Gustard, and R. Gross.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 205-212, 4 fig, 1 tab, 15 ref.

Descriptors: *Data analysis, *Europe, *Hydrologic data, *Hydrologic models, *Low flow, *Model studies, *Streamflow forecasting, Catchment areas, FREND project, Infiltration, Mathematical models, Regional analysis, Seasonal variation, Soil classification, Spatial variation, Winter rainfall acceptance potential.

The FREND (Flow Regimes from Experimental and Network Data) project employs an extensive database of daily flow data and catchment characteristics from national network and research basins throughout western Europe. Three years of study of the low flow regimes of 1350 rivers of northwest Europe were conducted as part of the FREND project. The controls on the spatial seasonal variability of low flow regimes were considered and the relationships between low flows and catchment characteristics were analyzed, with particular reference to the role of soil type in determining catchment response. Flow frequency analysis identified consistent relationships across the study area between the mean and the variability of annual minima and between low flows of different durations. Variability of annual runoff was shown to be related to the magnitude of runoff. Clear regional patterns of seasonal runoff were identified and the spatial variation of low flows appeared to be much greater than that of equivalent flood statistics. The success of the five-class (soil) WRAP (Winter Rainfall Acceptance Potential) map in predicting low flow behavior varied over the study area, but improvements could be made by returning to the European Community soil classes. Analysis of the frequency of occurrence of low flows revealed a remarkable consistency over the study area of the relationship between the magnitude of annual minimum flows and the variability of low flows. For example, from a knowledge of the 10-day duration mean annual minimum flow, estimates could be made on the annual minima of different return periods. (See also W91-06461) (Rochester-PTT)
W91-06483

REGIONAL ANALYSIS OF FLOW DURATION CURVES.
Fachhochschule Nordostniedersachsen, Suderburg (Germany, F.R.). Dept. of Civil Engineering.
H. Wittenberg.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 213-220, 3 fig, 3 tab, 1 ref.

Descriptors: *Data analysis, *Flow duration, *Germany, *Hydrologic data, *Model studies, *Regional analysis, *River flow, *Streamflow forecasting, Hydrologic models, Land use, Mathematical equations, Mathematical models.

Flow duration curves or numbers indicate on how many days of an average year discharges through a cross section of a river are reached or exceeded. In many countries flow duration curves are derived and published for gauging stations with sufficient records. However, planning engineers often have difficulty in deriving duration curves for ungaged river basins. In response to this problem a research study was conducted with the following objectives: (1) parameterization of duration curves (i.e., choice of a suitable mathematical equation and determination of parameter values for gaged river basins; (2) regionalization, correlation between shape parameters and basin properties to establish regional regression equations for the synthesis of duration curves for ungaged basins; and (3) analysis of the influence of urbanization on shape and parameters of flow duration curves. Data from three basins in the North-Rhine Westphalia area (Germany) were analyzed. A total of 24 basins in the three regions, with areas ranging from 3.4 to 770 sq km and representing hills and forests and an urbanized region (770 sq km) were used in the analysis. Good results were obtained using the three-parameter gamma function to model density functions of the flow duration curves. As simplification, flow duration curves of smaller, non-urbanized basins in the region may be described by the mass curve of the linear reservoir, thus depending on the parameter K only. This parameter is related to basin property; its value corresponds to mean flow of the basin under consideration. (See also W91-06461) (Author's abstract)
W91-06484

MORPHOLOGY AND DOWNSTREAM HYDRAULIC GEOMETRY RELATIONS OF ALLUVIAL STREAM CHANNELS IN A HUMID TROPICAL ENVIRONMENT, SOUTHWESTERN NIGERIA.
Ondo State Univ., Ado-Ekiti (Nigeria). Dept. of Geography.
F. S. Ebisemiju.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 221-236, 4 fig, 2 tab, 19 ref.

Descriptors: *Channel morphology, *Data analysis, *Geomorphology, *Hydraulic geometry, *Hydrologic data, *Model studies, *Nigeria, *Streamflow forecasting, Catchment areas, Elemi River, Experimental basins, Extrapolation, Geohydrology, Mathematical analysis, Open-channel flow, Regional analysis.

The study of the morphology alluvial channels in the Elemi River Basin, southwestern Nigeria, reveals that stream channel capacity is related only moderately to stream discharge indexed by basin area, but is controlled more strongly by bank cohesion, which accounts for 65% of the variance. Analysis of the downstream hydraulic geometry of the streams reveals that, while the coefficients and exponents are consistently high and closest to 1.0 for small ephemeral headwater streams, both decrease in the middle and lower reaches of larger streams and vary appreciably between streams of different sizes. The relationship between basin area and channel capacity is curvilinear (negative exponential) with two threshold basin areas at about 20 sq km and 100 sq km. The observed downstream changes in the hydraulic geometry relations are attributed to downstream changes in flow regime and increase in environmental heterogeneity as drainage basins area increases. The spatial variation in the downstream hydraulic geometry relations between streams also is strongly related to the variability in the channel perimeter cohesion index. These findings suggest that (1) site-specific rather than area factors are the main determinants of channel morphology in the area; (2) truly consistent and predictable relationships between channel size and basin area exist only along streams with homogeneous catchment and hydrological characteristics; and (3) the results of small catchment experiments cannot be extrapolated meaningfully to larger basins because of greater variability in channel perimeter stability, catchment characteristics, and flow regime. (See also W91-06461) (Author's abstract)
W91-06485

CHANGING FREQUENCY OF EXTREME HYDROLOGICAL EVENTS IN NORTHERN AND WESTERN EUROPE.
Institute of Hydrology, Wallingford (England).
N. Arnell.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 237-249, 5 tab, 13 ref.

Descriptors: *Data analysis, *Europe, *FREND project, *Flood frequency, *Floods, *Flow profiles, *Hydrologic data, *Model studies, *Streamflow forecasting, Climatic changes, Global warming, Prediction, Regional analysis, Temporal variation.

In the area of flow frequency analysis, the problems of detecting a possibly weak 'signal' from a 'noisy' process are compounded by the short periods of record generally available for analysis. One approach is to use data from many measuring sites over a large area to draw inferences about temporal trends using spatial characteristics of change. Such a regional perspective was adopted here to address the question of whether flood and low flow events are becoming more frequent in western Europe. Data collected for the FREND (Flow Regimes from Experimental and Network Data) project were employed in the analysis. Changes over time show a very strong spatial coherence across the study area, and reflect variations in climatic inputs. Recent years have seen more and bigger floods than earlier periods, related to an increase in wet winters and springs, but there in no evidence to suggest that very extreme floods are becoming more frequent. An increase in dry and warm summers does not appear to have resulted in lower low flows. Low flows were lowest over much of Europe during the mid-1970s, and only in parts of northern Britain and Denmark were low flows were experienced in the 1980s. The observed changes seem consistent with, but do not necessarily confirm, the possible effects of global warming associated with the greenhouse effect. It is apparent that the conventional approach of using flow records from the past as a reasonable model for the future is unrealistic. Determining the effects of temporal change on estimates of events with high return periods is difficult because such estimates have a high sampling variability even under stationary conditions. (See also W91-06461) (Rochester-PTT)
W91-06486

CONSEQUENCES OF THE RECENT CLIMATIC VARIATIONS ON RIVER FLOW REGIMES IN WEST AFRICA.
Lagos Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W91-06487

TESTS AND APPLICATION OF SOIL MOISTURE DEFICIT MODELS USED FOR ANALYSIS OF BASIN BEHAVIOUR.
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
L. Anderson.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 281-290, 5 fig, 1 tab, 13 ref.

Descriptors: *Data analysis, *Experimental basins, *Hydrologic data, *Hydrologic models, *Model studies, *Soil moisture deficiency, *Soil water, *Streamflow forecasting, *Sweden, Evapotranspiration, Forests, Grasslands, Groundwater recharge, Interception, Mathematical models.

The use of simulation techniques when describing the hydrological conditions within a basin always will be an abstraction of reality and even the most rigorous physically-based models are extreme simplifications of reality, forced by practical considerations to use equivalent parameter values over parts of the flow domain. The uncertainty of the large number of parameter values that needs to be determined for each grid element has limited the application and validation of these models on a basin scale. An attempt was made to find simple conceptual soil moisture models, driven by readily available meteorological data, that can be used to assess basin behavior. Using soil moisture observations from forest and grassland sites in Sweden and the United Kingdom, a range of daily soil moisture deficit (SMD) models were tested. The optimal combination of physical relevance and simplicity determined the ultimate choice of model structure used for an analysis of basin behavior in the Velen experimental basin (Sweden). Calculated moisture deficits, groundwater recharge, transpiration, and interception rates showed good agreement not only with point measurements but with the overall basin behavior. (See also W91-06461) (Rochester-PTT)
W91-06489

FOREST CUT AND FOREST REGENERATION EFFECTS ON WATER BALANCE AND RIVER RUNOFF.
Gosudarstvennyi Gidrologicheskii Inst., Valdai

(USSR).
S. F. Federov, and S. V. Marunich.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 291-297, 1 fig, 1 tab, 3 ref.

Descriptors: *Data analysis, *Forest watersheds, *Hydrologic budget, *Hydrologic data, *Model studies, *Soviet Union, *Streamflow forecasting, *Vegetation effects, Afforestation, Clear-cutting, Evapotranspiration, Experimental basins, River flow, Runoff, Spruce trees, Temporal variation, Time series analysis.

The water-regulating and water-protecting role of forests is widely acknowledged. Numerous experiments conducted in the Soviet Union have shown that the hydrological role of forest is subject to most significant changes as a result of different forestry practices (forest cut and forest regeneration) on small basins. Evapotranspiration regime changes in response to forest cutting. In one-year and two-year cuttings in spruce and pine forests, evapotranspiration from soil (from the forest understory with trees separate) is 45-60% of the evapotranspiration of the mature forest. After the forest is replanted or begins to regenerate naturally, the process of evapotranspiration recovery starts. By the time of climax spruce stand growth (40-45 yr), the evapotranspiration observed is 10-15% greater than that of the original mature forest. Subsequently there is a gradual decrease in evapotranspiration. Runoff also changes in response to forest cutting and regeneration. The greatest amounts of total runoff are seen in newly cut forests and the least amounts are seen in plots of 45-yr-old forest. Runoff values from the spruce forest of 95-100 yr age are less than those from a cleared plot, but greater than those from the 45-yr-old spruce stand. During regeneration of forests, groundwater regime also changes. Groundwater recharge from infiltration increased twice during the first decade after forest planting and twice during the second decade, thus reaching the conditions of a mature spruce forest. In the Sinia Gnilka experimental basin, total runoff was formed mainly from the surface component in the years before forest planting (1957-1961). After extensive afforestation (1971), the portion of runoff derived from groundwater reached 44%, which is close to the value typical of a basin with mature spruce cover. (See also W91-06461) (Rochester-PTT)
W91-06490

SMALL CATCHMENT STUDIES OF MAN'S IMPACT ON FLOOD FLOWS: AGRICULTURAL DRAINAGE AND PLANTATION FORESTRY.
Institute of Hydrology, Wallingford (England).
M. Robinson.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 299-308, 3 fig, 2 tab, 16 ref.

Descriptors: *Drainage effects, *England, *Experimental basins, *Floods, *Forest watersheds, *Ireland, *Scotland, *Vegetation effects, *Wales, Afforestation, Flood frequency, Land use, Soil water.

Drainage of agricultural land and the planting of the poorer land with man-made forests are major changes currently taking place in northern Europe; these activities may have widespread effects on river flows. Storm flows from drained an undrained land at eight experimental sites were analyzed and compared. The study brings together data from sites in England, Ireland, Scotland, and Wales. It was found that drainage may increase or decrease peak flows relative to undrained land, depending on a number of easily measured site characteristics. Soil properties and soil water regime prior to drainage are of critical importance in determining the direction and magnitude of hydrological change. Studies of plantation forestry at four sites indicate that the hydrological effects of tree growth and of the associated pre-planting ground drainage are often distinct and may act in opposite directions. The balance between them will change over time with growth of the trees and deterioration of the ditch system. The hydrological response of even a mature forest plantation may be different from that of the naturally regenerated (and undrained) woodlands often cited in textbooks. (See also W91-06461) (Author's abstract)
W91-06491

APPLICATION OF A LUMPED CONCEPTUAL MODEL TO FREND CATCHMENTS.
Institute of Hydrology, Wallingford (England).
R. Gross, C. W. O. Eeles, and A. Gustard.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 309-320, 9 fig, 9 ref.

Descriptors: *Catchment areas, *Data analysis, *FREND project, *France, *Hydrologic data, *Hydrologic models, *Model studies, *Streamflow forecasting, *Wales, Data requirements, Doller catchment, Drought, Elan Valley, Forest watersheds, Hore Catchment, Lumped conceptual models, Mathematical models, Performance evaluation, River flow, Simulation, Streamflow.

The Institute of Hydrology (Wallingford, England) lumped conceptual model uses flow records to optimize a number of parameters controlling separate interception, soil, and channel stores for several different land uses in a catchment. The model was applied in three studies: (1) in the Elan Valley catchment (central Wales) to estimate the effect of afforestation of the catchment on water resources; (2) in the Hore catchment (central Wales) to model the effects on low flows of large-scale clear cutting of a predominantly forested catchment; and (3) in predicting the effects of changes in afforestation of the Doller catchment (eastern France). Where sufficient data are available, the lumped conceptual model can be applied successfully to a variety of catchments. Data requirements of daily rainfall, flows, and evapotranspiration estimates for calibration of the model are small compared to those of physically-based models. The simulated flows agree well with those observed. A change in the emphasis of optimization of the model parameters may enable the low-flow part of the flow regime to be modeled more closely. Even with very limited meteorological data, coarse predictions of the direction and extent of change in flow regime are possible using the model. By applying low flow analysis techniques to the flow data produced by models of different levels of forest in a catchment, more details on the change in seasonal distribution of flows and the frequency of occurrence of certain levels of drought can be obtained. The combination of the lumped conceptual model and low-flow analysis techniques would be valuable in any preliminary analysis of the environmental impact or implications for water resources of proposed change in afforestation of a catchment. (See also W91-06461) (Rochester-PTT)
W91-06492

POSSIBILITY OF MATHEMATICAL MODEL APPLICATION TO EVALUATE MAN'S ACTIVITY EFFECTS ON RAINFALL RUNOFF HYDROGRAPH.
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
A. A. Kapatov, N. I. Kapatova, N. A. Livanova, and S. A. Kondratiev.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 321-329, 2 fig, 2 tab, 2 ref.

Descriptors: *Data analysis, *Hydrologic data, *Hydrologic models, *Model studies, *Rainfall-runoff relationships, *River flow, *Runoff, *Soviet Union, *Streamflow forecasting, Forest watersheds, Polomet River, Surface-groundwater relations, Time series analysis, Vegetation effects.

Computer models can be used to operationally evaluate the effects of man's activities on runoff processes. In making these estimates, the main runoff-producing factors are of great importance. Multipurpose investigations were made at the State Hydrological Institute (SHI) and its Valdai Branch (VB, Soviet Union) to develop a river basin model intended for study of rainfall runoff and evaluation of the effects of changes in the basin natural conditions on this process. Studies were conducted in the Polomet River basin, a 432-sq km area in which a long-term runoff series, a sufficiently dense precipitation gaging network, and radar measurements were available. The conditions of rainfall runoff formation in the Polomet basin are typical of forest basins. Surface runoff is extremely rare. Rainfall floods result from subsurface runoff, which may account for 80-100% of total river runoff. Submodels essential to the RBM of the Polomet River were developed to describe the formation of lateral inflow into the channel (subsurface flow) and flood wave routing. The basin scheme is based on the meshes of radar data averaging, every mesh being 11 sq km in area (3.3 x 3.3 km). The Polomet basin surface is represented as a population of sloping plots corresponding to 53 meshes of radar data averaging. A numerical experiment was conducted in which it was assumed that a successive forest cut had been made on 10 plots adjacent to the river channel over 10 yr. After the cut the forest regenerated. Runoff hydrographs were computed that were produced by rainfalls 50 mm deep during 1 hr, which correspond to the 1% frequency of rainstorms for the Valdai area. A change in evaporation after the cut (during forest regeneration) was included. For the specified conditions of runoff formation and forest cut practices, the increases in maximum discharges and runoff volumes observed corresponded to 36% and 53%, respectively, by the sixth year and 65% and 94% by the tenth year. When forest cuts are stopped, the opposite process occurs, although very slowly, with complete runoff recovery occurring only by the 25th year. (See also W91-06461) (Rochester-PTT)
W91-06493

NEAR SURFACE HYDROLOGICAL PROCESSES UNDER CHANGING LAND USE IN HUMID-EQUATORIAL CONDITIONS.
National Univ. of Singapore.
For primary bibliographic entry see Field 4C.
W91-06494

STUDIES ON THE DETERMINATION OF ANTHROPIC INFLUENCES ON THE HYDROLOGICAL REGIME IN SMALL BASINS.
Institutul de Meteorologie si Hidrologie, Bucharest (Romania).
For primary bibliographic entry see Field 4C.
W91-06495

ESTIMATION OF RIVER FLOWS WITH PARTICULAR REFERENCE TO NATURAL AND ARTIFICIAL COMPONENTS.
Severn-Trent Water Authority, Solihull (England). Rivers and Regulation Div.
J. Pirt.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 361-371, 2 fig, 7 ref.

Descriptors: *Data analysis, *Effluents, *England, *Hydrologic budget, *Hydrologic data, *Low flow, *Model studies, *River flow, *Streamflow forecasting, Drought, Residual flow diagrams, River Derwent, River Tame.

Measures of low river flow are required by the water industry for many purposes. When gaging station networks are not available or ar inadequate, flow must be estimated. There are several methods by which the natural component of flow of specific duration or frequency can be calculated, but stream flows typically have an artificial component. Although both components can change, changes in the artificial component can be both sudden and marked. Observations in the United Kingdom show the relative components of the flow, how they interact, and how stable they are. The residual flow diagram provides a hydrological snapshot of a river or catchment for a particular flow condition. Each significant influence on a river is quantified to provide an overall picture of the total flow at any point. Three types of data are

required for construction of residual flow diagrams: (1) river flows obtained from hydrometric networks and spot gagings; (2) water reclamation works discharges; and (3) abstractions and trade effluents. The Rivers Tame and Derwent are located in the same geographical region (English Midlands) and their sizes are similar, but because of geological, morphological, and meteorological effects the natural flows in the Derwent are double those in the Tame. However, because of massive artificial influences in the Tame, its dry weather flow is twice that of the Tame. Without a residual flow diagram it would be impossible to understand the comparative low-flow hydrology of these rivers. Analysis of time series at Stoke-on-Trent demonstrate that the disproportionate influence of changes in the artificial component on total flow. Such changes are pertinent to water quality, dilution ratios, and licensed abstractions downstream. The use of residual flow diagrams by water authorities would lead to improved methods of flow estimation on unmonitored reaches and sub-basins. (See also W91-06461) (Rochester-PTT)
W91-06496

FREND RESEARCH PROGRAMME: CONCLUSIONS AND RECOMMENDATIONS.
Institute of Hydrology, Wallingford (England).
A. Gustard.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 375-380, 1 ref.

Descriptors: *Data analysis, *Europe, *Experimental basins, *FREND project, *Hydrologic data, *Hydrology, *Model studies, *Network design, *Streamflow forecasting, Cooperation, Data acquisition, Floods, Low flow, Runoff, Technology transfer.

The FREND (Flow Regimes from Experimental and Network Data) project has developed an international hydrological data base by collating data from over 2000 small research basins and national network stations from northern and western Europe. The project has benefitted both from integrating national data bases and from the experience of using analysis techniques from a number of countries. Studies conducted as part of the FREND project include: flood studies, low-flow studies, research basin studies, and modeling human influences. These studies have produced results that demonstrate the value of the FREND project. Recommendations for the future are as follows: employ a more consistent approach to collecting, processing, and analyzing data to achieve the full potential of the research; initiatives aimed at improving links among research groups should be developed and extended; the full potential of the FREND data base should be exploited by implementing the second phase of the FREND project; the FREND data base should be extended to include longer time series and a consistent set of catchment characteristics across the study area to enable regional estimation techniques to be based on a coherent data set; the FREND data base should be used in further studies of changes in hydrologic time series, monitoring the frequency of extreme events; model developments using FREND data should cover a wide range of scales from detailed modeling at the plot scale to providing hydrologic input to general circulation models; and the feasibility of implementing the FREND program in a different climate region of the world should be considered. (See also W91-06461) (Rochester-PTT)
W91-06497

INTERNATIONAL CO-OPERATION ON HYDROLOGY OF THE CENTRAL AND EASTERN EUROPEAN COUNTRIES.
Warsaw Univ. (Poland). Faculty of Geography and Regional Studies.
U. Soczynska.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 381-390.

Descriptors: *Data analysis, *Europe, *Experimental basins, *FREND project, *Hydrologic data, *Hydrology, *International commissions, *Model studies, *Streamflow forecasting, Acid rain, Cooperation, Data acquisition, Evapotranspiration, Groundwater flow, Urbanization, Water quality.

Within the framework of the International Hydrological Programme (IHP) of UNESCO, regional projects with an objective to develop and consolidate collaboration in research on hydrological phenomena and processes in different natural environments of neighboring countries are considered of special importance. The national committees of the IHP in central and eastern Europe put forward the idea in 1968 of devising a number of mutual scientific research topics in the framework of regional cooperation. The regional projects were performed in seven countries: Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania, and the Soviet Union. The results of several of these studies that might be of interest for phase two of the FREND (Flow Regimes from Experimental and Network Data) project are summarized here. The projects accomplished are as follows: underground flow for the territory of central and eastern Europe; water balance maps for the territory of central and eastern Europe; international manual for the methods of the main hydrological characteristics design; and estimation of the impact of reservoirs on flow regime and water quality. Projects currently under way include: assessment of the effect of urbanization on the hydrological system and water quality; improvements of the methods for land evaporation estimation; methodological research in experimental basins; and influence of acid rainfall on water quality. (See also W91-06461) (Rochester-PTT)
W91-06498

ESTIMATION OF CHANGES OF RUNOFF FROM URBANIZED AND INDUSTRIALIZED CATCHMENT.
Institute of Meteorology and Water Management, Katowice (Poland).
For primary bibliographic entry see Field 4C.
W91-06500

FLOOD-CALCULATIONS IN NORWAY.
Norges Vassdrags- og Elektrisitetsvesen, Oslo. Hydrological Div.
L. E. Pettersson.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 419-421, 1 fig.

Descriptors: *Data analysis, *Flood forecasting, *Flood frequency, *Flood peak, *Floods, *Hydrologic data, *Model studies, *Norway, *Streamflow forecasting, Engineering hydrology, Maximum probable floods, Regional analysis, Spatial variation.

In the last 5-6 yr, the Hydrology Department of the Norwegian Water Resources and Energy Administration has executed flood calculations for 60 areas involving more than 100 dams. In calculations of water levels and discharges that form the basis for the design of spillways and outlet works, the design inflow flood is used (defined as the inflow flood occurring at a return period of 1000 yr, Q1000). For calculations to check the safety of a dam against failure, the probable maximum flood (PMF) is used. This is the greatest inflow flood that can occur from a catchment and cannot be related to a fixed return period. It is based on the most unfavorable combination of meteorological and hydrological conditions possible. Usually the year is divided into two flood seasons to provide homogeneous data for statistical analysis. Floods in spring and early summer are caused by snow melt, whereas autumn floods are caused mainly by precipitation alone. The values of Q1000 inflow flood, specific daily mean, range from approximately 400 L/sec per sq km in the most southeastern part of Norway to 3000 L/sec per sq km in some small catchments close to the southwestern coast. The ratio of PMF/Q1000 is mostly in the interval 1.7-2.2, giving PMF inflow flood values that range from around 800 to almost 5000 L/sec per sq km. (See also W91-06461) (Rochester-PTT)
W91-06502

RESEARCH DRAINAGE BASIN OF THE REAL COLLOBRIER (MEDITERRANEAN FRANCE): FLOW MODELIZATION AND REGIONAL ANALYSIS.
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Aix-en-Provence (France). Aix-en Provence Group.
J. Lavabre.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 423-434, 6 fig, 2 tab, 5 ref.

Descriptors: *Data analysis, *Experimental basins, *Flood frequency, *France, *Hydrologic data, *Hydrologic models, *Model studies, *Regional analysis, *Streamflow forecasting, Mathematical models, Real Collobrier, Streamflow.

The prediction of floods on ungaged catchments implies that a mathematical model use only climatological and simple and available physical parameters over the area studied. However, the model can be applied on well-known drainage basins by using a measurement system. This is one of the principal purposes of representative and experimental basins (REBs). A study was conducted using observations made in the drainage basins of the Real Collobrier REB in southern France (10 water level recorders and 28 rain recorders over an area of 100 sq km). A simple flood model was employed in which the production function has a single J parameter (potential interception of the drainage basin in mm). Floods were reconstructed using a triangular unit hydrograph. Four drainage basins were studied. The comparative results of the present study showed that the J production parameter varies from one drainage basin to another. Variation of J over time could not be explained deterministically. A seasonal probabilistic model was developed that makes it possible to study floods of long return period. (See also W91-06461) (Rochester-PTT)
W91-06503

FREQUENCY ANALYSIS OF FLOOD AND LOW FLOW.
Water and Environment Research Inst., Helsinki (Finland).
R. Leppajarvi.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 435-442, 2 fig, 2 tab, 11 ref.

Descriptors: *Data analysis, *Finland, *Flood frequency, *Frequency distribution, *Hydrologic data, *Low flow, *Model studies, *Streamflow forecasting, Gamma distribution, Gumbel distribution, Lognormal distribution, Performance evaluation, Return periods, Statistics.

In Finland a graphical method has been used to study average return periods of extreme discharges as well as the magnitudes of rare discharges. The present study sought to determine whether it was possible to use a probability distribution and the general frequency equation to achieve more accurate results for rarely occurring discharges or to estimate an average return period for a known discharge. Data were collected for maximum annual discharges (38 sites) and for minimum annual discharges (37 sites) in Finland; many sites were the same for both observation series. The probability distributions applied to the annual extremes were the Gumbel distribution (Fisher-Tippett I), the two-parameter lognormal distribution, and the two-parameter gamma distribution. The unknown parameters of the distribution were estimated by the method of moments and the method of maximum likelihood. The fit of the distributions was tested using the Kolmogorov-Smirnov test. The results showed that the distributions fitted at the 95% confidence level. When the standard frequency distribution was used and the 95% confidence limits were defined, it showed that the Gumbel distribution gave greater floods than the lognormal and gamma distributions and smaller low flows than the two others. The estimates calculated using the lognormal and gamma distributions were close to each other. In general, it was

concluded that the distributions fit better to floods than to low flows. (See also W91-06461) (Rochester-PTT)
W91-06504

LOW FLOW ANALYSIS.
Norges Vassdrags- og Elektrisitetsvesen, Oslo. Hydrological Div.
B. Krokli.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 443-451, 7 fig, 4 ref.

Descriptors: *Data analysis, *Hydrologic data, *Low flow, *Model studies, *Norway, *Streamflow, *Streamflow forecasting, Mathematical equations, Regional analysis, Regression analysis, Runoff, Seasonal distribution, Time series analysis, Ungaged basins.

To meet a growing demand for low flow data for ungaged sites, frequency and regression analyses were conducted using data from 172 stations in Norway, 135 of which had record lengths exceeding 30 yr. The annual minimum series were split into two populations, thus giving separate sets of equations for summer and winter seasons. Extreme value analysis was conducted to compute the mean annual D day minimum and the annual D day minimum of 10 yr return period, where D = 7, 30, and 60 days. To make stipulations possible in ungaged catchments, attempts were made to relate mean annual minimum discharge, 7-day average (i.e., MAM(7)) to physiographic parameters and to mean annual specific runoff for the period 1930-1960. To obtain homogeneous regions, different combinations of the 11 hydrological administrative regions of Norway and different hydrological regimes were tried. Multiple regression analysis was conducted using both untransformed data and logarithmically transformed data for absolute values (cu m/sec) and specific runoff (L/sec per sq km). Testing the regression equations on data for stations not in the analysis showed that the data set of logarithmically transformed data was clearly superior. Summer equations did not differ between regions 1, 2, 3, and 6, 7. Differences were apparent for the other regions. The winter equations for all regions were not significantly different from each other. (See also W91-06461) (Rochester-PTT)
W91-06505

REGIONAL HYDROLOGY: APPLICATIONS OF INFORMATION TECHNOLOGY.
Oslo Univ. (Norway). Dept. of Geography.
B. Erichsen.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 479-481, 1 fig, 6 ref.

Descriptors: *Data acquisition, *Data analysis, *Hydrologic budget, *Hydrologic data, *Hydrologic models, *Model studies, *Norway, *Regional analysis, *Streamflow forecasting, Cooperation, Data processing, Drought, Floods, Snowmelt.

A project was conducted based on cooperation between the University of Oslo, the Norwegian Water Resources and Energy Administration, and the Norwegian Meteorological Institute. The intention of the project was to investigate and develop methods for application of the steadily increasing volume of hydrologically relevant data available in digital form. Work so far has concentrated on developing an informative data base and investigation of the use of maps and video presentation to illustrate the regional variation in time series. Regional development of droughts and floods in Norway and snowmelt process development in major rivers were the first topics studied. The work with regional floods and droughts was the first attempt at interpolation from point values to areal values done for southern Norway. An inverse distance weighting procedure was used. The result is satisfying so far, considering the simple method. A simple distributed model has been developed for snow melting in a larger catchment. The raster format was chosen because data storage and access are easier than with the vector format. The accuracy is highly dependent on grid resolution, which in this case was 1 sq km. The development of methods to transform scales without losing essential information is of great importance. (See also W91-06461) (Rochester-PTT)
W91-06508

TIME-LAPSE STREAMFLOW OVER NORTH AMERICA.
Time-Lapse Systems, Inc., Seattle, WA.
W. Tangborn.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 483-491, 2 fig, 4 ref.

Descriptors: *Canada, *Data analysis, *Hydrologic data, *Model studies, *Streamflow, *Streamflow forecasting, *Time-lapse mapping, *United States, Alaska, Computer programs, Graphical analysis, Long-term studies, Maps, Runoff, Video.

A time-lapse sequence of mapped daily streamflow over 48 adjacent United States, Alaska, and southern and western Canada has been developed on video tape. Records of mean daily stream discharge for the 1930 through 1988 period were used. Maps of daily streamflow were generated using 235 subregions defined by the United States Geological Survey's standard hydrologic map series and the Canadian Department of Energy and Mines Drainage Index map series. Each subregion was represented by a gaged drainage basin, so that the daily mean discharge observed at a gaging station was assumed to have the same unit flow over the entire subregion. The AutoCAD graphics software package was used to generate the subregion base map. The map generated for each day was in 13 colors, varying from dark blue for high flows to dark red for low flows. In addition to condensing years of data into a short visual experience, the time-lapse approach provides clues about subtle weather-related patterns. The database used to generate the time-lapse pictures is ideal for further analysis of phenomena depicted on the videotape. The data can be manipulated on the computer screen to generate composite maps to show, for example, changes in streamflow over time, drought-prone regions, absolute runoff, and various statistical determinations such as mean annual and mean monthly runoff. (See also W91-06461) (Author's abstract)
W91-06509

RUNOFF AND EROSION IN CLEARINGS FOLLOWING CUTTING OF THE HUMID TROPICAL FOREST (ECOULEMENTS ET EROSION SOUS PRAIRIES ARTIFICIELLES APRES DEFRICHEMENT DE LA FORET TROPICALE HUMIDE).
Office de la Recherche Scientifique et Technique Outre-Mer, Cayenne (French Guiana).
For primary bibliographic entry see Field 4C.
W91-06521

FROM THE PLOT TO THE WATERSHED: SCALE EFFECT IN THE AMAZONIAN FOREST ECOSYSTEM (DE LA PARCELLE AU PETIT BASSIN-VERSANT: EFFET D'ECHELLE DANS L'ECOSYSTEME FORESTIER AMAZONIEN).
Office de la Recherche Scientifique et Technique Outre-Mer, Cayenne (French Guiana).
For primary bibliographic entry see Field 2B.
W91-06522

INFILTRATION AND REDISTRIBUTION OF OVERLAND FLOW AND SEDIMENT ON A LOW RELIEF LANDSCAPE OF SEMI-ARID, TROPICAL QUEENSLAND.
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
M. Bonell, and J. Williams.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 199-211, 2 fig, 2 tab, 27 ref.

Descriptors: *Australia, *Forest hydrology, *Overland flow, *Runoff, *Sediment transport, *Semiarid lands, Forest fires, Infiltration, Rainfall-runoff relationships, Runoff volume, Slopes, Soil erosion, Storm runoff.

There is a dearth of knowledge concerning the runoff and erosion processes in the eucalypt woodland communities which occupy the smooth plains of tropical, semiarid Australia. Furthermore, the effect of fire has virtually been neglected. The processes of overland flow and sediment transfer under natural rainfall were examined for a sloping area of open eucalypt woodland in Queensland, using a cascade system of five troughs, 10 m long, offset at 25-m intervals. Runoff-runon, infiltration, and sediment flux were calculated from simple equations. It was found that the variability of runoff-runon over these low relief landscapes demonstrates the value of a cascade system of unbounded collection troughs. Only small amounts of rain at 10 mm/h or greater are required for ponding and the initiation of overland flow, most of it is redistributed and subsequently infiltrates as a consequence of the short duration of storms, the low slope angle, and the relatively high field saturated hydraulic conductivity of the soil between the scattered herbaceous groundcover. The spatial heterogeneity of surface soil hydraulic properties causes some sections of the slope to export runoff and sediment while other sections accept water and sediment as runon and sediment, allowing a continuous relationship between deposition and runon to be established. The net loss from the slope under the present land use is small and, from the event sequence studied for two years, was not significantly altered by fire, although sediment movement was increased following fire. (See also W91-06510) (Fish-PTT)
W91-06529

GEOMORPHIC AND VEGETATIVE RECOVERY PROCESSES ALONG MODIFIED TENNESSEE STREAMS: AN INTERDISCIPLINARY APPROACH TO DISTURBED FLUVIAL SYSTEMS.
Geological Survey, Nashville, TN.
For primary bibliographic entry see Field 4A.
W91-06534

WATER RELEASE FROM A FORESTED SNOWPACK DURING RAINFALL.
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. Snow Hydrology Project.
For primary bibliographic entry see Field 2C.
W91-06535

EFFECTS OF FORESTS ON WETLAND RUNOFF DURING SPRING.
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M.-K. Woo, and R. Heron.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 297-307, 5 fig, 10 ref.

Descriptors: *Forest hydrology, *Runoff, *Snow cover, *Vegetation effects, *Wetlands, Canada, Forest watersheds, Frost, Groundwater runoff, Ontario, Rainfall-runoff relationships, Snow accumulation, Snowdrift, Snowmelt, Solar radiation, Subarctic zone, Surface runoff.

Forested wetlands occur extensively in many subarctic regions of the world. The hydrological characteristics of wetlands are responsible for the development paths of the forested belts to varying extent; but the presence of a forest also affects the hydrology of the existing wetlands. The influence of the forested belts upon the runoff pattern of a subarctic wetland was examined by measuring snow accumulation, radiation, snowmelt, and ground frost in a forested wetland in northern Ontario, Canada, in 1985 before, during, and after the snowmelt season. During winter, the forest edges accumulated much drifting snow (1.2 m maximum), providing meltwater to the open wetlands in spring. Short-wave radiation varied from 250-700 W/sq m, depending on cloud cover; the presence of a forest reduces the incident short-

wave radiation, particularly during the clear days. The melt rates for the bog and shrub areas exceeded those for the forests. Lower energy input and a longer duration of snow cover prolonged the duration of ground frost in the forest for at least three weeks longer than at the open site. Three types of runoff can be distinguished in the forested wetland areas: overland flow, channelled flow, and subsurface flow. Runoff mode, direction, and magnitude are controlled by the spatial and temporal variations of the water supply and the thickness and duration of ground frost. Since the forests occur on higher ground, they often produced groundwater mounds that deflected the paths of flow in the wetlands. Surface flow peaked in early spring but as meltwater supply diminished and as ground frost disappeared, groundwater flow prevailed in summer. (See also W91-06510) (Fish-PTT)
W91-06538

STREAMFLOW CHARACTERISTICS OF TWO SMALL, STEEP AND FORESTED WATERSHEDS IN HIGH ELEVATION AREAS OF CENTRAL TAIWAN.
British Columbia Ministry of Forests, Kamloops. Hydrology Research Section.
For primary bibliographic entry see Field 4C.
W91-06557

CHANGES IN STREAMFLOW PEAKS FOLLOWING TIMBER HARVEST OF A COASTAL BRITISH COLUMBIA WATERSHED.
British Columbia Univ., Vancouver. Faculty of Forestry.
For primary bibliographic entry see Field 4C.
W91-06558

RUNOFF FORMATION CONCEPT TO MODEL WATER PATHWAYS IN FORESTED BASINS.
Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Geographie.
A. Herrmann, J. Koll, M. Schoniger, and W. Stichler.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 519-529, 4 fig, 31 ref.

Descriptors: *Forest hydrology, *Forest watersheds, *Hydrologic models, *Model studies, *Surface-groundwater relations, *Watershed management, Flood hydrographs, Germany, Groundwater movement, Hydraulic properties, Hydrography, Porous media, Soil water, Surface flow.

Making process-near hydrograph simulation and forecast models available depends on substantial conceptual innovation. Starting from common model concepts, ideas are being developed as to runoff formation by using the Lange Bramke basin/Harz Mts. in Germany (0.76 sq km, 543-700 m above mean sealevel, 90% forested) as an example. These ideas are mainly based on the experimental results from isotopical hydrograph separation, sprinkling, and groundwater table monitoring. Evidence was seen of spontaneous hydraulic response of fractured rock and porous aquifers causing important exfiltration to streams, and of efficient macropore systems in the unsaturated soil zone which guarantee rapid compensation of groundwater losses. It may be concluded from these observations that the old concept of surface flow mostly generating flood hydrographs must be revised. Future tasks concern regional diversification of experiments, mapping of variable subsurface source areas (aquifers), and numerical model treatment of relevant hydrologic and hydraulic parameters. (See also W91-06510) (Author's abstract)
W91-06559

EFFECT OF CLEARCUTTING ON STREAMFLOW GENERATING PROCESSES FROM A SUBALPINE FOREST SLOPE.
Forest Service, Fort Collins, CO.
For primary bibliographic entry see Field 4C.
W91-06562

EFFECT OF ASPEN HARVEST AND GROWTH ON WATER YIELD IN MINNESOTA.
North Central Forest Experiment Station, Grand Rapids, MN. Forestry Sciences Lab.
For primary bibliographic entry see Field 4C.
W91-06563

EFFECTS OF WHOLE-TREE CLEARCUTTING ON STREAMFLOW CAN BE ADEQUATELY ESTIMATED BY SIMULATION.
Northeastern Forest Experiment Station, Durham, NH. Forestry Sciences Lab.
For primary bibliographic entry see Field 4C.
W91-06564

SIMULATION OF EFFECTS OF FOREST GROWTH ON WATER YIELD WITH A DYNAMIC PROCESS-BASED USER MODEL.
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4C.
W91-06565

EXTRAPOLATION OF RESEARCH RESULTS BY DETERMINISTIC MODELS.
Warsaw Univ. (Poland). Faculty of Geography and Regional Studies.
For primary bibliographic entry see Field 2A.
W91-06566

SIMULATION OF WATER FLOW AND SOIL EROSION PROCESSES WITH A DISTRIBUTED PHYSICALLY-BASED MODELLING SYSTEM.
Danish Inst. of Applied Hydraulics, Hoersholm.
For primary bibliographic entry see Field 2J.
W91-06567

ANALYSIS OF STORMFLOW AND ITS SOURCE AREA EXPANSION THROUGH A SIMPLE KINEMATIC WAVE EQUATION.
Forest and Forest Products Research Inst., Kyoto (Japan). Kansai Branch.
M. Tani, and T. Abe.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 609-615, 5 fig, 9 ref.

Descriptors: *Forest hydrology, *Forest soils, *Hydrologic models, *Kinematic wave theory, *Rainfall-runoff relationships, *Storm runoff, Channel flow, Japan, Mannings equation, Mountains, Simulation analysis, Slopes, Soil moisture deficiency, Soil water.

In humid, well-vegetated regions, the usual range of rainfall intensity is smaller than that of the saturated conductivity of the forest floor, and all rain falling onto unsaturated areas must enter the soil. Stormflow passes through complicated pathways including the ground surface, the soil matrix, and macropores within the soil. Analyzing the responses of storm runoff to rainfall may show the characteristics of the complex flow. Characteristics of stormflow and its source area expansion in a mountainous basin were considered by analyzing responses of stormflow to rainfall, using a simple kinematic wave equation. Hydrographs for various storms observed in an experimental basin (17.3 ha) in Japan were well simulated through the analysis. It was found that the stormflow had more intense nonlinearity than that derived from the Manning formula, and that the source of the stormflow originated from the channel area and expanded upslope as rainfall increased. The expansion was generated by the distribution of threshold soil water deficit, which should also be reduced by the soil water movement after rainfall ceased. The shrinkage process of the source area after a storm needs further study. (See also W91-06510) (Fish-PTT)
W91-06568

CONTRIBUTION OF BEDROCK GROUNDWATER FLOW TO STORM RUNOFF AND HIGH PORE PRESSURE DEVELOPMENT IN HOLLOWS.
California Univ., Berkeley. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W91-06575

HYDROGEOMORPHOLOGICAL CHARACTERISTICS OF A ZERO-ORDER BASIN.
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Forestry.
Y. Tsukamoto, and H. Minematsu.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 61-70. 7 fig, 1 tab, 10 ref.

Descriptors: *Erosion, *Geohydrology, *Geomorphology, *Rainfall-runoff relationships, *Slope stability, *Soil properties, *Weathering, Colluvial soils, Groundwater movement, Landslides, Mass wasting, Overland flow, Permeability, Saturated flow, Storm runoff, Storms.

A zero-order basin is a slope unit characterized by frequent discharge of weathered materials. The topographical development of a zero-order basin is described by the relationship between slope types, soil properties, mass slides, storm runoff processes and the occurrence of saturated overland flow. The depth of the subsurface flow in a slope is a determining factor in the development of topography of a zero-order basin. An important result is that the variable source area is predominant in low relief mountains and liquefaction of colluvial deposits is predominant in high relief mountains. Frequent occurrence of widespread expansion of saturated overland flow area in a hollow requires bed materials under the surface soil composed of impermeable, clay rich materials or impermeable rocks; ground water levels high enough to generate saturated overland flow in small storms; and, hollows with gentle gradients and wide, flat bottoms. (See also W91-06570) (Brunone-PTT)
W91-06576

TOMBI LANDSLIDE AND ITS IMPACT ON THE JOGANJI RIVER, JAPAN.
Chuo Univ., Tokyo (Japan). Inst. of Geosciences.
For primary bibliographic entry see Field 2J.
W91-06584

FORESTED BLOCK SLIDES IN THE LOWER REDWOOD CREEK BASIN, NORTHWEST CALIFORNIA.
Redwood National Park, Orick, CA.
For primary bibliographic entry see Field 2J.
W91-06589

LARGE-SCALE DEBRIS AVALANCHE AS AN EPISODE IN SLOPE-CHANNEL PROCESSES.
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 2J.
W91-06595

EROSION PROCESSES AND EFFECTS OF DEBRIS FLOW.
Chengdu Inst. of Geography (China).
For primary bibliographic entry see Field 2J.
W91-06596

MOBILIZATION OF DEBRIS FLOWS FROM SHALLOW SLIDES.
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W91-06597

SOIL LOSSES AND RUNOFF RATES FROM THE FORESTED WATERSHEDS IN KOREA.
Seoul National Univ. (Republic of Korea). Dept. of Forestry.
For primary bibliographic entry see Field 2J.
W91-06603

SEDIMENT YIELDS AND SURFACE RUNOFF FROM SIX TYPES OF AGROFORESTRY AT MAE-KLONG WATERSHED RESEARCH STATION, KANCHANABURI, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Watershed Management Div.
For primary bibliographic entry see Field 2J.
W91-06605

POST-FIRE RESPONSE OF A BOULDER-BED CHANNEL.
Pacific Southwest Forest and Range Experiment Station, Riverside, CA.
For primary bibliographic entry see Field 2J.
W91-06612

RELATIONSHIPS BETWEEN CHANNEL MORPHOLOGY, UNIT STREAM POWER, AND SEDIMENT ROUTING AND STORAGE IN A STEEP, BEDROCK CONTROLLED CHANNEL.
California Univ., Santa Barbara. Dept. of Geological Sciences.
J. L. Florsheim, and E. A. Keller.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 279-280.

Descriptors: *California, *Channel morphology, *Channel storage, *Computer modeling, *Geomorphology, *Model studies, *Sediment transport, Backwater, Bedrock, Channels, Flow rates, Riparian waters, Sedimentation, Streams.

A study was conducted to obtain a better understanding of the basic fluvial processes associated with the volumetric and areal distribution of channel deposits in steep, bedrock controlled stream channels, and to evaluate the effects of wildfire on sediment routing in the chaparral riparian system. Relationships between channel morphology, energy slope, unit stream power distribution, and sediment storage and routing over a spectrum of low to high magnitude discharges were examined in a small, 2.14 sq km, drainage basin which is a tributary of Matilija Creek located in the western Transverse Ranges north of Ventura, California. Modeling flow events utilizing the HEC-2 step backwater computer program suggests: (1) energy gradients at all flows are steep through bedrock construction; (2) energy gradients are relatively gentle upstream of constrictions in areas affected by backwater flow and downstream of constrictions where channel expansions occur; (3) the length of channel affected by backwater flow upstream of constrictions is less at low discharge than at high discharge; (4) peaks in unit stream power occur in bedrock constrictions while minima occur in areas affected by backwater flow and in channel expansions; (5) the spatial distribution of sediment deposition during a low magnitude flow is greatly influenced by bedrock controlled channel geometry; and (6) although the distribution of unit stream power is often complex, modeling explains the gross location of sediment deposits and thus, routing. (See also W91-06570) (Brunone-PTT)
W91-06613

SEDIMENT TRANSPORT AND DEPOSITION BY FIRE-RELATED DEBRIS FLOWS IN SOUTHERN CALIFORNIA.
California Univ., Los Angeles. Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06615

OVERVIEW: CHANNEL MORPHOLOGY AND SEDIMENT TRANSPORT IN STEEPLAND STREAMS.
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
T. E. Lisle.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 287-297. 55 ref.

Descriptors: *Channel morphology, *Channel scour, *Geomorphology, *Sediment transport, *Streams, Bed-load discharge, Braided streams, Channel storage, Debris flow, Heterogeneity, Mathematical models, Meanders, Model studies, Particle size, Reservoirs, Slopes.

New understanding of how steepland channels are formed is being pursued over a large range of scales, from entrainment of bed particles to the transfer of stored sediment down channel systems. Low submergence of bed particles during transport and wide heterogeneity in particle sizes strongly affect bedload transport. At the scale of a reach, scour-lobes are becoming widely recognized as common constructional units governing behavior of braided, meandering, and pool-riffle channels. Channel morphology and sediment transport can be radically altered by infrequent debris flows and torrents, however, which provide a common linkage between mass movement on hillslopes and sediment transport in channels. Because of the impracticality of monitoring the downstream progress of sediment over meaningful periods, sediment routing is best approached by mathematical models that incorporate the age and volume of sediment in storage reservoirs. (See also W91-06570) (Author's abstract)
W91-06616

INITIAL MOTION OF COARSE SEDIMENT IN STREAMS OF HIGH GRADIENT.
Washington Univ., Seattle. Dept. of Geophysics.
For primary bibliographic entry see Field 2J.
W91-06617

CRITICAL CONDITIONS FOR BED MATERIAL MOVEMENT IN STEEP, BOULDER-BED STREAMS.
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W91-06618

MODELLING BED-LOAD TRANSPORT IN STEEP MOUNTAIN STREAMS.
Ministry of Works and Development, Lower Hutt (New Zealand). Central Labs.
For primary bibliographic entry see Field 2J.
W91-06619

NEW MODELS OF HYDROLOGICAL AND STREAM CHANNEL RELATIONSHIPS.
Washington State Univ., Pullman.
J. F. Orsborn, and J. M. Stypula.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 375-384. 3 fig, 4 tab, 12 ref.

Descriptors: *Channel morphology, *Hydraulic models, *Hydrological models, *Model studies, *Oregon, Aquatic habitats, Ecosystems, Flow rates, Model testing, Resource management, Streamflow.

A study was conducted to develop a basis for the interrelationships among the geometric characteristics of stream channels and streamflow from which the natural or modified state of streams could be determined. A series of ten model and thru test stream gaging stations in the mid-coast region of Oregon were selected for investigation. Relationships used to hydrologically, hydraulically and geometrically characterize streams include: (1) at-a-station hydraulic geometry, (2) regional hydraulic geometry, and (3) a new expression for relating channel boundary shear to channel shape. A regional hydraulic geometry model was developed for basins in the mid-coast region of Oregon. The regional model was integrated into the new expression for channel shear and shape. The dimensionless shear-shape relationship expresses the stream channel width-to-depth ratio as a function of the wetted perimeter and the flow area. Estimates of widths, depths and velocities for average annual flows compare favorably with actual values. Possible applications of these new models include on-site flow estimation, fish habitat estimation, regional hydrological models, and a sequence of hydrological, hydraulic and fisheries habitat models. (See also W91-06570) (Brunone-PTT)
W91-06624

HYDRAULICS AND TRANSPORT AT HIGH FINE SEDIMENT LOADS.
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W91-06625

INCISED CHANNEL AND TERRACE FORMATION NEAR MOUNT ST. HELENS, WASHINGTON.
Eton Coll., Windsor (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06627

PREDICTING CHANNEL RESPONSES TO CHANGING FLOW REGIMES: BEAVER CREEK, ALASKA.
Bureau of Land Management, Lakewood, CO. Denver Service Center.
For primary bibliographic entry see Field 2J.
W91-06629

LICHENOMETRIC DATING APPLIED TO FLOOD DEPOSITS.
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 7C.
W91-06630

HYDROLOGICAL REGIME AND FLUVIAL PROCESSES IN BASALTIC MOUNTAINOUS AREAS.
Haifa Univ. (Israel). Dept. of Geography.
M. Inbar.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 399.

Descriptors: *Channel erosion, *Erosion, *Fluvial sediments, *Hydrological regime, *Israel, *Mountain streams, Bed load, Climates, Floods, Golan Heights, Particle size, Rainfall, Rainfall-runoff relationships, Runoff, Sediment yield, Sedimentation, Suspended sediments.

Basalt plains composed of thick columnar jointed flows are characterized by deep incised channels into these wide plateaus. Fluvial processes are mainly determined by lithological factors. The studied area included five major basins in the Golan Heights. Elevations range from 200 m below to over 1000 m above sea level but despite this range the physiography is quite homogenous. Rainfall is of a Mediterranean type, ranging from 400 to 900 mm per year. Hydrological data were obtained from 8 hydrometric recording stations. Suspended sediment was collected during flood events. Bedload transport was measured by sediment types. Runoff follows rainfall events in the rainy period. For most of the streams, storm runoff accounts for more than three-quarters of total runoff. Runoff starts after 200 mm of rainfall; the runoff/rainfall ratio is in the order of 30 to 50% and the mean yearly value is only about 10 to 20%. Peak floods are above 100 cu m/sec in the lower reaches. Suspended sediment yield is low. Bedload material is coarse and composed mainly of pebbles and boulders, with a unimodal sediment size distribution that reflects uniform energy conditions during sedimentation. In the lower part of the basins, channels are characterized by braided depositional systems, with very coarse bedloads, which act as cohesive material under most flow conditions. (See also W91-06570) (Brunone-PTT)
W91-06632

DISCHARGE AND SUSPENDED SEDIMENT OF THE UPPER NAN RIVER, NAN PROVINCE, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Watershed Management Div.
For primary bibliographic entry see Field 2J.

W91-06633

SLACKWATER HABITAT IN TORRENT-IMPACTED STREAMS.
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
P. R. Kaufmann.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 407-408. 1 fig, 2 ref.

Descriptors: *Aquatic habitats, *Channel morphology, *Detritus, *Flooding, *Mathematical models, *Model studies, *Oregon, *Scour, *Slackwaters, *Streams, *Torrents, Backwater, Channel storage, Correlation analysis, Darcy-Weisbach equation, Flow rates, Sedimentation, Thalweg.

Debris floods and torrents can greatly alter the channels of small streams in the Oregon Coast Range, causing both increases and decreases in the amount and size of pools and other slackwater features important for fish habitats. Fourteen 100 m reaches in three streams were selected to encompass the variability in channel conditions observed during recovery following torrent scour or deposition. Residual pool vertical profile area was calculated as an index of pool volume from longitudinal profiles of channel thalweg bottom elevation measured in 1985. Dye tracers were used to obtain corresponding data on hydraulic transit time and dispersion. Transient storage volume fraction estimates were calculated from concentration-time data using a transient storage model. Dead zone fraction ranged from 0.3 to 0.6, corresponding with residual pool volume ($r = 0.94$) and SDD, the standard deviation of thalweg depth ($r = 0.95$). Darcy-Weisbach friction factors (f) ranging from 2 to 90 were highly correlated with SDD within restricted ranges of discharge ($r = 0.95$ to 0.98). Regressions of f versus SDD showed more scatter when combined over a wider range of discharge. The large pool and dead zone volumes in several reaches were primarily associated with woody debris. Among the three study streams, the greatest total pool volume, dead zone fraction, and channel complexity occurred in torrent deposit reaches of Cape Creek, representing an intermediate torrent recovery stage. Debris flood and torrent scouring, therefore, appeared to reduce pool volume, dead zone fraction and channel complexity. (See also W91-06570) (Brunone-PTT)
W91-06636

CONSERVATION OF FISH HABITAT IN STREAMS BY THE METHOD OF LOW DAMS SERIES.
Toyama Prefectural Coll. of Technology, Kosugi (Japan).
For primary bibliographic entry see Field 8I.
W91-06637

GEOMORPHIC AND HYDROLOGIC CONDITIONS FOR COLD POOL FORMATION ON REDWOOD CREEK, CALIFORNIA.
Redwood National Park, Arcata, CA.
V. L. Ozaki.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 415-416. 1 fig, 2 ref.

Descriptors: *Anadromous fish, *Aquatic habitats, *California, *Fisheries, *Geomorphology, *Redwood Creek, *Sedimentation, *Water temperature, Aggradation, Channel morphology, Gravel, Groundwater, Meanders, Mixing, Scour, Seasonal variation, Thermal stratification, Woody debris.

Widespread streambed aggradation in Redwood Creek in coastal northern California, during the last few decades severely impacted important nursery habitats for anadromous fish stocks. The physical processes responsible for controlling and maintaining summer cold pools were investigated on Redwood Creek. Five pools were studied in the lower 21 km of the main channel of Redwood Creek. Detailed morphologic and topographic maps were made of each pool. Cold pools on Redwood Creek provide areas of concentrated cold water which maintain summer water temperatures several degrees Celsius below mainstem temperatures. In Redwood Creek, pools typically form on the outside of meander bends and are often associated with scour around bedrock outcrops or large woody debris. Channel morphology strongly influenced the occurrence and development of cold pools. Cross-sectional temperature profiles showed that a gravel bar sill or barrier effectively retarded mixing of the warmer mainstem water with cold pool water. Woody debris in the channel was unstable and often shifted during winter flows. Cold pools were sustained by a complex interaction of water sources. Mass balance calculations indicated that tributary flow and upwelling of subsurface water were the primary sources of cold water which maintained summer cold pools in Redwood Creek. Bottom seepage from groundwater and intragravel flow accounted for 100% of the cold water discharge in pools not associated with tributary inflow, and comprised up to 43% of flow in pools located at tributary mouths. (See also W91-06570) (Brunone-PTT)
W91-06640

RESIDENCE TIMES OF CHANNEL-STORED SEDIMENT IN REDWOOD CREEK, NORTHWESTERN CALIFORNIA.
Redwood National Park, Arcata, CA.
For primary bibliographic entry see Field 2J.
W91-06642

BANKFULL DISCHARGE AND SEDIMENT TRANSPORT IN NORTHWESTERN CALIFORNIA.
Geological Survey, Menlo Park, CA.
K. M. Nolan, T. E. Lisle, and H. M. Kelsey.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 439-449. 3 fig, 2 tab, 26 ref.

Descriptors: *Bankfull stage, *California, *Flow rates, *Sediment transport, *Suspended sediments, Channel erosion, Flood recurrence interval, Gaging stations.

High-magnitude, low-frequency discharges are more responsible for transporting suspended sediment and forming channels in northwestern California than in previously studied areas. Bankfull discharge and the magnitude and frequency of suspended sediment discharge were determined at five gaging stations in northwestern California. Although discharges below which 50% of the suspended sediment was transported and discharges which transport the greatest suspended sediment (effective discharge) occurred relatively frequently, recurrence intervals for these discharges were relatively high when compared to data from other areas. Likewise, discharges below which 90% of the suspended sediment was transported were also relatively infrequent. In most cases, the recurrence interval of bankfull discharge was several times greater than that of the effective discharge, because floodplain formation appears to be due more to overbank deposition during large sediment-laden discharges than to lateral channel migration and point bar formation. (See also W91-06570) (Author's abstract)
W91-06643

EROSION PROCESS IN THE MIDDLE AND UPPER REACHES OF THE YANGZI RIVER.
Chengdu Inst. of Geography (China).
For primary bibliographic entry see Field 2J.
W91-06647

CONTROLS ON THE RELATION OF STREAMSIDE LANDSLIDING TO CHANNEL SEDIMENT STORAGE IN A REGION OF ACTIVE UPLIFT.
Western Washington Univ., Bellingham. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W91-06652

EROSION, TRANSPORT AND DEPOSITION PROCESSES.
For primary bibliographic entry see Field 2J.
W91-06717

FIELD EXPERIMENTS ON THE RESISTANCE TO OVERLAND FLOW ON DESERT HILLSLOPES.
State Univ. of New York at Buffalo. Dept. of Geography.
A. T. Abrahams, A. J. Parsons, and S.-H. Luk.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 1-18, 7 fig, 1 tab, 31 ref. NATO Grant RG. 85/0066.

Descriptors: *Deserts, *Field tests, *Flow resistance, *Overland flow, *Slopes, Arid lands, Arizona, Darcy-Weisbach equation, Floods, Flow profiles, Hydrographs, Mathematical studies, Reynolds number, Runoff.

At-a-section and downslope variations in resistance to overland flow on desert hillslopes have been investigated by performing a series of experiments on six runoff plots in southern Arizona. The surface of these plots are irregular and covered with stones. As overland flow increases, the stones and microtopographic protruberances, which constitute the major roughness elements, are progressively inundated, thereby altering the flow resistance. Analyses of 14 cross sections reveal that the relation between the Darcy-Weisbach friction factor (f) and the Reynolds number (Re) has two basic shapes: convex-upward and negatively sloping. These shapes are explained in terms of the simultaneous operation of two processes. The first is the progressive inundation of roughness elements and increase in their wetted upstream projected area as discharge increases. This process causes f to increase. The second is the progressive increase in the depth of flow over already inundated parts of the bed as discharge increases. This process causes f to decline. Whether the f-Re relation has a positive or a negative slope depends on whether the first or the second process dominates, and this depends on the configuration of the bed and the level of the discharge. These findings have profound implications for the mathematical modeling of overland flow on desert hillslopes, as the computed overland flow hydrograph is very sensitive to the form of the f-Re relationship. The downslope analyses indicate that there is a general tendency for f to decrease down the runoff plots, owing to the progressive downslope concentration of flow. This finding contrasts with Emmetts conclusion that f remains approximately constant downslope because of ponding behind microtopographic highs, notably vegetation mounds. This finding appears to be more representative than Emmett's of sparsely vegetated desert hilltops. (See also W91-06717) (Author's abstract)
W91-06718

EMPIRICAL RELATIONSHIPS FOR THE TRANSPORT CAPACITY OF OVERLAND FLOW.
Katholieke Univ. Leuven (Belgium). Lab. voor Experimentele Geomorfologie.
For primary bibliographic entry see Field 2J.
W91-06720

EVOLUTION OF AN ANTHROPOGENIC DESERT GULLY SYSTEM.
Oxford Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06721

RELATIONSHIP BETWEEN SEDIMENT DELIVERY RATIO AND STREAM ORDER: A ROMANIAN CASE STUDY.
Statiunea de Cercetari Stejarul, Piatra-Neamt (Romania). Geomorphology Lab.
For primary bibliographic entry see Field 2J.
W91-06722

SIMULATION MODEL FOR DESERT RUNOFF AND EROSION.
Leeds Univ. (England). School of Geography.
M. Kirkby.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 87-104, 17 fig, 15 ref.

Descriptors: *Deserts, *Erosion, *Model studies, *Simulation analysis, *Surface runoff, Arid lands, Evapotranspiration, Flood routing, Geohydrology, Hydrologic models, Infiltration, Overland flow, Rainfall-runoff relationships, Regoliths, Slopes, Soil water.

A distributed hillslope hydrological model is presented for a slope profile strip of variable width. It is based on stores representing soil moisture in an irregular bedrock surface, partially or entirely covered by a colluvial and/or wind-blown regolith. The model is used to explore the variations in infiltration, overland flow, soil moisture and evapotranspiration in response to differences in rainfall totals and storm durations, and in gradient and regolith depth and uniformity. Infiltration is separately estimated for bedrock and regolith components with evapotranspiration estimated from local soil moisture storage, and therefore persists longer in areas with only partial regolith cover. Biological activity is related to storage and evapotranspiration rates. Overland flow is routed downslope as a one-dimensional kinematic wave. The model is also used in aggregate form for longer periods to estimate erosion by overland flow. (See also W91-06717) (Lantz-PTT)
W91-06723

SPATIAL VARIABILITY OF OVERLAND FLOW IN A SMALL ARID BASIN.
Bar-Ilan Univ., Ramat Gan (Israel). Dept. of Geography.
H. Lavee, and A. Yair.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 105-120, 15 fig, 1 tab, 10 ref.

Descriptors: *Arid lands, *Israel, *Overland flow, *Rainfall-runoff relationships, *Spatial variation, Deserts, Evaporation, Hydrologic budget, Infiltration, Model studies, Negev Desert, Slopes, Surface flow.

Overland flow generation and continuity along hillslopes in a small arid drainage basin in the northern Negev, Israel, has been assessed on the basis of field measurements. Variables measured include: rainfall, overland flow, evaporation, infiltration rates and soil moisture. Data obtained show great spatial and temporal variability among all variables. The most frequent phenomenon encountered was overland flow discontinuity along slopes having lengths ranging from 55 to 76 m. This discontinuity is attributed to the short duration of rain showers and can be enhanced by surface properties (where the infiltration rate increases downslope). A deterministic simulation model for the spatial and temporal variations in overland flow along the hillslopes was developed taking into consideration the spatial and temporal distribution of the variables mentioned above. The model is based upon functions derived from the field measurements and permits the delineation of the hillslope area contributing to channel flow under various rain conditions. Results obtained may explain the use of certain water harvesting techniques adopted by farmers living in the area some 2000 years ago. (See also W91-06717) (Author's abstract)
W91-06724

TOWARDS A DYNAMIC MODEL OF GULLY GROWTH.
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06725

DYNAMICS OF GULLY HEAD RECESSION IN A SAVANNA ENVIRONMENT.
Bayero Univ., Kano (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06726

CONDITIONS FOR THE EVACUATION OF ROCK FRAGMENTS FROM CULTIVATED UPLAND AREAS DURING RAINSTORMS.
Katholieke Univ. Leuven (Belgium). Lab. voor Experimentele Geomorfologie.
For primary bibliographic entry see Field 2J.
W91-06727

SEASONAL VARIATIONS OF RUNOFF RATES FROM FIELD PLOTS IN THE FEDERAL REPUBLIC OF GERMANY AND IN HUNGARY DURING DRY YEARS.
Trier Univ. (Germany, F.R.). Angewandte Physische Geographie, Fach Fernerkundung.
G. Richter, and A. Kertesz.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 161-168, 9 fig, 1 tab.

Descriptors: *Field tests, *Germany, *Rainfall-runoff relationships, *Romania, *Runoff rates, *Seasonal variation, *Sediment yield, Climatic effects, Coastal environment, Precipitation, Runoff, Sediment transport, Soil water, Surface runoff, Temperature.

Plot measurements from the Mosel region (FRG) and from northern Hungary have been used to compare seasonal variations of surface runoff and sediment production in two different types of moist-temperate climates. In addition to seasonal contrasts between summer and winter periods, the following differences have been detected: under the maritime west coast climate of the western part of the Federal Republic of Germany, surface runoff and sediment production during the summer exceeded that in the winter. In contrast, under the humid continental climate of Hungary, having with its mediterranean influence, autumn rainfall and snowmelt in early spring often exert a dominant role. This situation was evident during the measurement period; there were also years with a summer maximum runoff. Beside precipitation distribution, temperature and soil moisture regimes contribute to these findings obtained under extreme conditions. The measurement series from both areas point to the existence of semiarid years with 300-450 mm precipitation per year, which are prone to further modifications. (See also W91-06717) (Author's abstract)
W91-06728

COMPARISON OF THE DIETARY COMPOSITION OF EPILITHIC TRICHOPTERAN SPECIES IN A FIRST-ORDER STREAM.
Max-Planck-Inst. fuer Limnologie, Schlitz (Germany, F.R.). Limnologische Flussstation.
For primary bibliographic entry see Field 2H.
W91-06752

OBSERVATIONS ON THE PHYTOBENTHOS OF THE FRESHWATER THAMES: III. THE FLORISTIC COMPOSITION AND SEASONALITY OF ALGAE IN THE TIDAL AND NON-TIDAL RIVER.
British Museum of Natural History, London (England). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W91-06760

EFFECT OF LONG-TERM WATER VELOCITY CHANGES ON STREAMBED BIOFILM ACTIVITY.
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 5B.
W91-06859

MORPHOLOGICAL ASSESSMENT OF SOIL MICROTOPOGRAPHY USING A DIGITAL ELEVATION MODEL ON ONE SQUARE METRE PLOTS.
Centre de Recherches de Rennes (France). Lab. de Science du Sol.
P. Bruneau, and C. Gascuel-Odoux.
Catena, Vol. 17, No. 4/5, p 315-325, August/October 1990. 5 fig, 14 ref.

Descriptors: *Data acquisition, *Depression storage, *Model studies, *Morphology, *Overland flow, *Photogrammetry, *Soil erosion, *Soil surfaces, *Topography, Cultivated lands, Geomorphology, Infiltration, Mapping, Runoff.

Depression storage restrains overland flow and erosion. A technique for delimiting areas of depression storage from Digital Elevation Models (D.E.M.s) involves mapping local and simple geomorphological features, based upon the comparison of the elevation of each point with each of its neighbors. These features are mapped and the morphology of depression storage, connections and flow lines between the depressions are then accurately identified. The method is illustrated with an example from a field in which maize had just been harvested. D.E.M.s in the form of altitude matrices were established by photogrammetry for plots of about 1 sq m at 1 cm spacing on square grids. The analysis of the D.E.M.s identified and delimited small storage depressions, some of which were isolated and others interconnected, in the middle of the spaces between the rows of the crop. (Author's abstract)
W91-06904

STREAM HEAD MIGRATION: AN INDICATOR OF RUNOFF PROCESSES ON CHALKLANDS.
Institute of Hydrology, Wallingford (England).
A. Calver.
Catena, Vol. 17, No. 4/5, p 399-408, August/October 1990. 3 fig, 11 ref.

Descriptors: *Calcareous soils, *Erosion rates, *Geomorphology, *Gully erosion, *Runoff, *Stream discharge, *Streamflow, Base flow, Channel erosion, Drainage patterns, England, Groundwater recharge, Storms.

The changing extent of headwater streamflow was monitored in four catchments in a chalk region of southern England by taking monthly readings under conditions of baseflow and hydrological events of significance. The four streams showed a seasonal migration of their upstream limit, producing an annual cycle of stream extension and retraction. Superimposed on these annual cycles are short-lived extensions occurring shortly after large rainfall events: sufficiently large summer storms produced extensions similar to winter baseflow conditions. Maximum winter and minimum summer positions were not synchronous in the four streams. Volume and frequency of streamflow were associated with differing degrees of boulder clay cover and it was suggested that a key process is lateral flow via field drainage systems. This holds implications for groundwater recharge as well as for surface streamflow. These mechanisms may be expected to occur in many areas of agriculturally-improved heavy soils on chalk. (Geiger-PTT)
W91-06908

HEAVY METALS AND ORGANIC MICROPOLLUTANTS IN FLOODPLAINS OF THE RIVER WAAL, A DISTRIBUTARY OF THE RIVER RHINE, 1958-1981.
Institute for Soil Fertility, Haren (Netherlands).
For primary bibliographic entry see Field 5B.
W91-06936

INFLUENCE OF TIDAL CONDITIONS AND RIVER VOLUME ON PHYTOPLANKTON DISTRIBUTION AND COMPOSITION IN THE PAS ESTUARY (NORTHERN SPAIN).
Cantabria Univ., Santander (Spain). Lab. de Ecologia.
For primary bibliographic entry see Field 2L.
W91-06939

WATER INTERCHANGE BETWEEN THE RIA OF VIGO AND THE COASTAL SHELF.
Instituto de Investigaciones Marinas, Vigo (Spain).
For primary bibliographic entry see Field 2L.
W91-06940

EFFECTS OF SUBSTRATE ON DENSITY OF AQUATIC INSECTS IN A SOUTHEAST NEBRASKA STREAM.
Nebraska Univ.-Lincoln. Dept. of Entomology.
P. O. Darrow, and K. P. Pruess.
Transactions of the Nebraska Academy of Sciences TNASDJ, Vol. 17, 1989. p 19-22, 1990. 1 fig, 2 tab, 16 ref.

Descriptors: *Aquatic insects, *Ecological effects, *Nebraska, *Population density, *Streams, *Substrates, Beetles, Caddisflies, Environmental effects, Fluvial sediments, Mayflies, Midges.

Effects of artificial substrate on aquatic insect density were studied in Haines Branch, Lancaster County, Nebraska. Treatments consisted of small, medium, large, and mixed (mixture of small and medium) concrete substrates in modified basket samplers. Three replicates of each treatment were removed at 14 and 28 days and aquatic insects were then enumerated. Insects collected were chironomids (63%), mayflies (19%), caddisflies (15%), and beetles (3%). Mean mayfly densities, averaged over all substrate treatments, were higher on day 28 than on day 14, while the reverse was observed for chironomid densities. Mean densities for mayflies and chironomids were higher in medium and large than in small substrate samplers. Chironomid densities were higher in large substrate treatments versus medium and in uniform versus mixed substrate treatments. No significant treatment effects were found for the remaining taxa. It is concluded that neither substrate size nor heterogeneity are good predictors for insect densities in this stream. (Author's abstract)
W91-07008

CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE MISSOURI RIVER, NEBRASKA.
Nebraska Game and Parks Commission, Norfolk.
For primary bibliographic entry see Field 6G.
W91-07009

EFFECT OF BUOYANCY ON TRANSVERSE MIXING IN STREAMS.
Stevens Inst. of Tech., Hoboken, NJ. Dept. of Civil, Environmental and Coastal Engineering.
For primary bibliographic entry see Field 5B.
W91-07030

BOUNDARY SHEAR STRESS AND ROUGHNESS OVER MOBILE ALLUVIAL BEDS.
EA Northwest Operations, Redmont, WA.
For primary bibliographic entry see Field 2J.
W91-07031

EFFECTS OF MOMENTUM TRANSFER IN COMPOUND CHANNELS.
University of the Witwatersrand, Johannesburg (South Africa).
For primary bibliographic entry see Field 8B.
W91-07032

OPTIMAL SPECTRAL BASE-FLOW ESTIMATION.
Mexican Inst. of Water Technology, Progreso.
J. Collado, A. A. Aldama, and J. L. Acosta-Rodriguez.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1540-1546, December 1990. 1 fig, 14 ref.

Descriptors: *Base flow, *Mathematical models, *Stream discharge, *Stream gages, *Streamflow, *Surface-groundwater relations, Aquifer characteristics, Aquifer systems, Discharge hydrographs, Fourier analysis, Intermittent streams, Linear programming, Mathematical equations, Model studies.

A physically-motivated technique based on linear systems theory for base-flow estimation in perennial and effluent streams that exclusively requires daily (total) flow measurements is proposed. An attenuated and lagged ideal low-pass filter that transforms observed discharges into base flow is identified by examining the conceptual characteristics of aquifer depletion. The values of the filter parameters are determined through optimization, involving a filtering step in frequency domain and a search procedure both in frequency and time domains. The method is applied to an actual stream-gaging record, showing good performances even in the absence of rainless periods and also in handling total flow hydrographs with multiple peaks. (Hoskin-PTT)
W91-07034

AGGRADATION AND DEGRADATION OF ALLUVIAL SAND DEPOSITS, 1965 TO 1986, COLORADO RIVER, GRAND CANYON NATIONAL PARK, ARIZONA.
For primary bibliographic entry see Field 2J.
W91-07041

TRAVELTIME AND REAERATION COEFFICIENTS FOR THE NORTH PLATTE RIVER, CASPER TO ORIN, WYOMING.
Geological Survey, Cheyenne, WY. Water Resources Div.
J. G. Rankl, and M. A. Carnevale.
1989. 34p, 11 fig, 6 tab, 24 ref.

Descriptors: *Aeration, *Path of pollutants, *Platte River, *River flow, *Traveltime, Dispersion, Dye dispersion, Flow discharge, Flow velocity, Oxygen, Reaeration, Tracers.

The opportunities for accidental spills of hazardous wastes into the North Platte River between Casper and Orin, Wyoming, are numerous. The movement of materials that may be spilled or discharged into the North Platte River and the measurement of reaeration coefficients are described in this report. Four traveltime and dispersion measurements were made on the North Platte River between Casper and Orin. The first measurement was made at a discharge of 940 cu ft/sec on November 7-8, 1978. The second measurement was made at a discharge of 3,100 cu ft/sec on May 14-15, 1985. The third and fourth measurements were made in conjunction with a reaeration measurement on October 9-12, 1985. The discharge for the third measurement was about 800 cu ft/sec, and the discharge for the fourth measurement was about 890 cu ft/sec. For a large range of stream discharges, the rate of movement of soluble material spilled or discharged into the North Platte River can be estimated from graphs developed from the four traveltime measurements. The following traveltime characteristics were developed: traveltime of the center of the dye cloud as a function of stream discharge, dye cloud passage time as a function of distance, and unit peak concentration as a function of traveltime. The rate of oxygen uptake by the North Platte River can be estimated from measured reaeration coefficients. On the basis of gas and dye tracer data for a stream discharge of 800 cu ft/sec, reaeration coefficients were measured for three reaches of the North Platte River. The three reaches, which have a total distance of 37.0 river miles, extended from Casper to the Dave Johnston Power Plant near Glenrock. Reaeration coefficients were measured using the modifier-tracer technique for both the area and peak methods. Computed reaeration coefficients ranged from 4.85 to 6.70/day at 20 C, in base-e logarithm units. (Lantz-PTT)
W91-07042

SURFACE-WATER QUALITY IN THE WEST BRANCH SUSQUEHANNA RIVER BASIN, PENNSYLVANIA: AN APPRAISAL OF AREAL AND TEMPORAL VARIABILITY FROM 1962 TO 1982 IN HYDROLOGIC ACCOUNTING UNIT 020502.
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5G.
W91-07043

HYDROLOGICAL CHARACTERISTICS AS A DETERMINANT OF SEDIMENT DELIVERY IN WATERSHEDS.
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W91-07067

2F. Groundwater

PRELIMINARY INVESTIGATION ON ACIDIFICATION OF GROUND WATER IN FINNISH WELLS.
Water and Environment Research Inst., Helsinki (Finland).
For primary bibliographic entry see Field 5C.
W91-06097

STATIONARY PACKER SYSTEM FOR LAYERWISE GROUNDWATER SAMPLING IN MONITORING WELLS--TECHNIQUE AND RESULTS.
Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
For primary bibliographic entry see Field 7B.
W91-06098

SOME FACTORS AFFECTING DISTRIBUTION OF DIATOM ASSEMBLAGES IN PYRENEAN SPRINGS.
Barcelona Univ. (Spain). Dept. de Ecologia.
For primary bibliographic entry see Field 2H.
W91-06270

STUDY ON THE EFFECT OF CHANGES OF GROUNDWATER LEVELS ON SOIL MOISTURE CONDITION AND EVAPOTRANSPIRATION.
Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology.
H. S. Lumadjeng.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 265-279, 7 fig, 5 tab, 12 ref.

Descriptors: *Data analysis, *England, *Evapotranspiration, *Hydrologic data, *Hydrologic models, *Model studies, *Soil water, *Streamflow forecasting, *The Netherlands, Hupselse Beek, MUST model, Mathematical models, Performance evaluation, Soil physics, Water table fluctuations.

When water is limiting in vegetated areas, plants try to adapt to the situation by increasing their suction through the roots and closing their stomata to reduce the transpiration flux. Soil water regime is important in determining the degree and duration of water stress experienced by plants. The Model for Unsaturated flow above a Shallow water Table (MUST) was employed in simulation of evapotranspiration processes at Hupselse Beek catchment (The Netherlands) and a simulation of soil water regimes responses to water table lowering in Yarnton (England). An investigation was conducted into the model sensitivity to different input parameters and computations of evapotranspiration under different meteorological, land use, and soil conditions. Simulation of the evapotranspiration process and responses of soil water regimes to annual water table fluctuations using the MUST model give satisfactory results within the constraints of the available data and model limitations. The model has a relatively simple conception compared to other models for unsaturated flows, but it still requires detailed soil physical and hydraulic conductivity data. Within the Hupselse Beek area there exist some significant differences in evaporation rates due to variability in the soil horizons and water table ranges. It appears that a finer distinction of the soil layers is necessary for correct representation of the profile. Sensitivity analysis conducted with Yarnton data showed that the three root zone layers could be approximated by one horizon without any significant differences in the results. It can be concluded vertical variability as well as horizontal variability within the soil profile could be important depending on soil char-

acteristics. Simulations of the impact of water table lowering on soil water regimes in Yarnton have shown that historical and prevailing soil moisture conditions were important for the assessment of regimes responses. (See also W91-06461) (Rochester-PTT)
W91-06488

RECOVERY OF A NEW MEXICO DRAINAGE BASIN FROM A FOREST FIRE.
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
S. B. Bolin, and T. J. Ward.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 191-198, 4 fig, 1 tab, 5 ref.

Descriptors: *Accelerated erosion, *Forest fires, *Forest hydrology, *Forest watersheds, *New Mexico, *Runoff, *Watershed management, Deforestation, Flood peak, Flow discharge, Sediment discharge, Sediment transport, Sediment yield.

New Mexico is a semiarid state with essentially all surface water originating as runoff from forested drainage basins. When these basins are disturbed by natural or man-made events, a vital part of the state's water resource is affected. In 1977, a fire burned approximately 60% of a 45.33-sq-km forested basin in northern New Mexico. Following the fire, water discharge was high and erratic. Peak flow was 100 times greater than the pre-fire levels. Suspended sediment concentrations immediately following the fire were as high as 98,800 mg/L. Two years after the fire, peak sediment concentrations dropped to less than 600 mg/L. In the first two years after the fire, an estimated 23,290 tons of sediment were removed from the basin compared to 10 tons over the next two years. Analyses showed that the sediment yield began as a transport-limited phenomena, but eventually returned to a more typical supply-limited situation. (See also W91-06510) (Author's abstract)
W91-06528

RUNOFF FORMATION CONCEPT TO MODEL WATER PATHWAYS IN FORESTED BASINS.
Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Geographie.
For primary bibliographic entry see Field 2E.
W91-06559

SUBSURFACE PIPEFLOW DYNAMICS OF NORTH-COASTAL CALIFORNIA SWALE SYSTEMS.
Forest Service, Arcadia, CA.
For primary bibliographic entry see Field 2J.
W91-06577

TERRAIN ANALYSIS FOR QUANTITATIVE DESCRIPTION OF ZERO-ORDER BASINS.
Queen Mary Coll., London (England). Dept. of Geography and Earth Science.
For primary bibliographic entry see Field 2J.
W91-06582

GROUND WATER QUALITY CONCERNS ABOUT NITROGEN.
Agricultural Research Service, Fort Collins, CO. Soil-Plant-Nutrient Research Unit.
For primary bibliographic entry see Field 5B.
W91-06732

SOURCES OF NITRATE TO GROUND WATER.
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W91-06733

NITRATE IN GROUND WATER IN THE UNITED STATES.
Iowa Dept. of Natural Resources, Iowa City.
For primary bibliographic entry see Field 5B.
W91-06734

LINKAGES WITH GROUND WATER.
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 363-372, 2 fig, 27 ref.

Descriptors: *Groundwater movement, *Infiltration, *Nitrates, *Nonpoint pollution sources, *Path of pollutants, *Percolation, Aquifers, Fertilizers, Flow velocity, Irrigation, Nitrogen compounds, Percolating water, Percolation rate, Porosity, Soil water, Vadose water.

In nonirrigated areas, downward flow or deep percolation rates (Darcy flux) in the vadose zone typically range from approximately 1 mm/yr or less for semiarid or arid areas, to approximately 500 mm/yr or more for humid areas. Irrigated areas in dry climates can have deep percolation rates as few as cm/yr to a few dm/yr for relatively efficient irrigation systems, and as much as 1 or 3 m/yr for inefficient irrigation systems. Assuming an NO3-N leaching of 50 kg/ha/yr (approximately one-fourth of the fertilizer N applied), these fluxes give calculated NO3-N concentrations in vadose zone water of 10 to 100 mg/L, which agree with values found in practice. To prevent high NO3-N concentrations in vadose zone water below irrigated areas, best management practices for irrigation must be combined with best management practices for nitrogen fertilizer. Rates of downward movement of nitrate in the vadose zone are equal to the pose velocities of the water. Theoretically, these are calculated as Darcy flux divided by volumetric water content. Because of preferential flow, however, actual velocities can be considerably higher, (i.e., 2 to 5 times higher) for soils without obvious macropores, and as much as 20 times higher or more for soils with cracks, rootholes, wormholes, etc. Downward velocities of nitrate in the vadose zone below agricultural land may range from a few dm/yr to a few m/yr. Longitudinal dispersion may be influenced more by spatial variability of infiltration rates than by hydrodynamic effects. Nitrate concentrations in water pumped from the aquifer eventually can approach those in water from the vadose zone. Where nitrate concentrations exceed the maximum limit for drinking, treatment of the water may be necessary. Of the various techniques, a method that combines anion exchange and denitrification holds promise. (See also W91-06717) (Author's abstract)
W91-06743

TRANSFORMATIONS AND MOVEMENT OF NITRATE IN AQUIFER SYSTEMS.
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Lab.
For primary bibliographic entry see Field 5B.
W91-06744

PRESENT GROUNDWATER STATUS IN EGYPT AND THE ENVIRONMENTAL IMPACTS.
H. Idris, and S. Nour.
Environmental Geology and Water Sciences EGWSEI, Vol. 16, No. 3, p 171-177, November/December 1990. 3 fig, 16 ref.

Descriptors: *Aquifers, *Egypt, *Environmental impact, *Groundwater availability, *Groundwater resources, *Hydrologic data collections, Geohydrology, Groundwater data, Groundwater depletion, Groundwater management, Groundwater pollution, Groundwater potential, Groundwater quality, Groundwater recharge, Saline water intrusion.

he status of groundwater studies in Egypt is reviewed briefly. In terms of groundwater hydrology, Egypt can be divided into the following groundwater provinces: (1) the Western Desert, (2) the Eastern Desert-Sinai, (3) the Nile Valley, (4) the Northern Coastal Zone, and (5) Wadi El-Natrun. The source of groundwater in the Western Desert groundwater system is the Nubian Sandstone Aquifer. It is estimated that the amount of water that may be extracted from the system ranges from 140 million cubic meters per year to 1.2 billion cubic meters per year. The Eastern Desert-Sinai system is characterized by a sedimentary zone and an igneous zone and the exploitable water contained in this system is estimated to be 31 million cubic meters per year. One of the main aquifer systems in Egypt is the Pleistocene alluvial aquifer underlying the Nile basin regions (i.e., the delta and Nile Valley). The total annual extraction from the delta and Nile Valley aquifers is estimated to be on the order of 1.6 and 1.3 billion cubic meters per year, respectively. Groundwater reservoirs of the Coastal Aquifer System are recharged from local rainfall. It is estimated that the annual exploitable groundwater could be on the order of 49.84 million cubic meters. Wadi El-Naturn, one of the most northerly topographical depressions in the Western Desert of Egypt, consists of a shallow sandy freshwater-bearing zone. A total discharge of 5000 cubic meters/hour is used in cultivating 6000 acres. Additional wells are envisaged for this aquifer system. However, pollution of the freshwater aquifer as a result of saline water intrusion from local saltwater lakes is possible. (Korn-PTT)
W91-06798

APPLICATION OF MARINE SEISMIC PROFILING TO A GROUND WATER CONTAMINATION STUDY, ABERDEEN PROVING GROUND, MARYLAND.
Geological Survey, Towson, MD.
For primary bibliographic entry see Field 5B.
W91-06849

USE OF A STANDPIPE TO EVALUATE GROUND WATER SAMPLERS.
Geological Survey, Stennis Space Center, MS.
For primary bibliographic entry see Field 7B.
W91-06853

GROUND WATER CONTAMINATION AT WOOD TREATMENT FACILITIES.
Lockheed Engineering and Sciences Co., Inc., Las Vegas, NV.
For primary bibliographic entry see Field 5B.
W91-06854

ANALYSIS OF NITRATE-NITROGEN IN GROUND WATER BENEATH UNSEWERED SUBDIVISIONS.
Wisconsin Univ.-Eau Claire.
For primary bibliographic entry see Field 5B.
W91-06855

INVESTIGATION OF POSSIBLE CONTAMINATION OF SHALLOW GROUND WATER BY DEEPLY INJECTED LIQUID INDUSTRIAL WASTES.
National Water Research Inst., Burlington (Ontario). Groundwater Contamination Section.
For primary bibliographic entry see Field 5B.
W91-06856

TRACING THE INFLUX OF SEWAGE FROM A LEAKY SEWER INTO A VERY THIN AND FAST-FLOWING AQUIFER.
Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wasserguetewirtschaft und Gesundheitsingenieurwesen.
For primary bibliographic entry see Field 5B.
W91-06867

MANAGEMENT OF GROUND-WATER RESOURCES USING SIMULATION MODELS.
National Geophysical Research Inst., Hyderabad (India).
C. P. Gupta, and M. Thangarajan.
Water Resources Journal, No. 164, p 34-42, March 1990. 5 fig.

Descriptors: *Groundwater management, *Groundwater movement, *Mathematical models, *Model studies, *Simulation analysis, *Water resources management, Aquifers, Artificial recharge, Geohydrology, Groundwater mining, Groundwater recharge, Sensitivity analysis.

In order to evolve appropriate schemes for an optimal utilization of groundwater resources, in conjunction with surface water and rain water, it is imperative to study and quantify the aquifer response to a set of most probable input and output stresses. Aquifer modeling involves identifying the physical characteristics of the aquifer and stresses acting on it; field estimation of as many hydrogeological parameters as possible; interpolation of these parameters to characterize the entire area under study; integration of all available hydrological data to conceptualize and resurrect the full-scale natural system; mathematically describing the conceptual model giving spatio-temporal relationship between those parameters constrained by the fundamental laws of hydraulics; and solving the mathematical equations describing the groundwater regime in terms of observables such as groundwater levels or concentrations of pollutants. A sensitivity analysis of the model and refinement of the model should bring plausibility and compatibility between field estimates of the various geohydrological parameters through calibration. The prognosis of the aquifer should be used to evolve efficient management options for optimal utilization of groundwater resources. A mathematical model was tested to identify the effects of pumping on an open cast mine. A prognostic study of the aquifer response to a number of probable pumping options indicated that a further decline in the regional groundwater piezometric heads could result, and identified artificial recharge to contain the decline of piezometric heads. A prognostic run showed that a battery of injection wells through which a part of the pumped groundwater could be fed back to the system reduced the drawdown due to an augmented recharge. (Geiger-PTT)
W91-06900

BIOLOGICAL SURVEY OF GROUND WATER FROM THE TEHRAN PLAIN, IRAN.
Tehran Univ. (Iran). School of Pharmacy.
M. Shariatpanahi, and A. C. Anderson.
Water Resources Journal, No. 164, p 58-62, March 1990. 1 fig, 3 tab, 14 ref.

Descriptors: *Biological pollution, *Drinking water, *Drinking water sources, *Groundwater pollution, *Iran, *Water quality, Algae, Aqueducts, Aquifers, Bacteria, Leaching, Path of pollutants, Protozoa, Water table rise.

The city of Tehran, Iran relies heavily on groundwater as a source of drinking water. Since the city lacks municipal sewage facilities, there is potential for seepage from pit privies, seepage pits, and leaching cess-pools into the groundwater aquifer. Rises in the groundwater table in recent years may increase the potential for groundwater contamination and limit groundwater use. The biological quality of Tehran's groundwater was surveyed for its safety by sampling 50 sources of water used for drinking and washing. The sample sites included 43 wells and seven aqueducts that were evenly distributed throughout the city of Tehran. Virtually all regions showed microbial contamination of the water sources. Water samples from aqueducts generally had a greater number and variety of organisms than did the wells. Generally, the number of wells showing bacterial indicators increased from north to southeast. This is due, in part, to the shallow water table in the south-east, and the possibility of infiltration of sewage from seepage pits and sewage wells which may penetrate into groundwater aquifers. In this survey, bacteria, algae, and ciliates predominated. Factors which could influence microbial movement in soils include rainfall, soil moisture, soil type, soil ion content, and other soil physical properties. The presence of bacteria indicates the need for rigorous disinfection, public health education, and attention to individual decontamination practices prior to use. (Geiger-PTT)
W91-06901

TRANSPORT OF GROUNDWATER-BORNE NUTRIENTS FROM WATERSHEDS AND THEIR EFFECTS ON COASTAL WATERS.
Boston Univ., MA. Marine Biological Lab.
For primary bibliographic entry see Field 5B.
W91-06950

GROUNDWATER CONTRIBUTION TO THE NUTRIENT BUDGET OF TOMALES BAY, CALIFORNIA.
San Jose State Univ., CA. Dept. of Geology.
J. A. Oberdorfer, M. A. Valentino, and S. V. Smith.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 199-216, 1990. 5 fig, 4 tab, 24 ref. NSF Grant OCE 8613647.

Descriptors: *Bays, *California, *Groundwater movement, *Hydrogeology, *Model studies, *Nutrient transport, Ammonium, Dissolved inorganic carbon, Groundwater chemistry, Nitrogen compounds, Phosphates, Seasonal variation.

Tomales Bay, a graben structure along the San Andreas Fault, was selected for modeling ecosystem nutrient dynamics because of its linear, one-dimensional morphology and relatively pristine state. Groundwater is a potentially important term in the nutrient budget. The geologic complexities created by the San Andreas Fault, however, complicate the hydrogeology and require the area to be subdivided into three regions: granite to the west, Franciscan to the east, and alluvial fill in the trough. Nutrient concentrations in the groundwater were determined through extensive well sampling; groundwater discharge was estimated using both Darcy's Law calculations and a soil moisture budget. Results indicate that groundwater discharge is of the same order of magnitude as summer streamflow into the Bay, while being significantly less than other freshwater inputs in winter. Dissolved nutrient (phosphate, nitrate + nitrite, ammonium, silica and dissolved inorganic carbon) concentrations in groundwater were consistently higher (by as much as an order of magnitude) than in surface water discharges. During the summer months, groundwater flow contributes about as much nutrient load to the bay as does streamflow. During the winter, the groundwater contribution to nutrient loading is about 20% of the streamflow contribution. The findings indicate that groundwater is a significant component of terrestrial nutrient and freshwater loading to Tomales Bay, particularly during the summer months. However, neither groundwater nor streamflow nutrient fluxes are large in comparison to the mixing flux at the Bay mouth of the flux of N2 gas across the air-water interface. (Author's abstract)
W91-06951

INFLUENCE OF TIDAL MARSHES ON UPLAND GROUNDWATER DISCHARGE TO ESTUARIES.
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2L.
W91-06952

GROUNDWATER SEEPAGE ALONG A BARRIER ISLAND.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. Bokuniewicz, and B. Pavlik.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 257-276, 1990. 6 fig, 37 ref.

Descriptors: *Barrier islands, *Groundwater movement, *New York, *Saline groundwater, *Saline-freshwater interfaces, *Seepage, Bays, Freshwater, Model studies, Oceans, Saline water, Water level fluctuations, Wave action, Wells, Wind.

Measurements were made on a barrier island on the south shore of Long Island, New York to examine the distribution of fresh groundwater and the potential for recirculation of saline groundwater. A standard resistivity survey was done to examine the distribution of fresh and saline groundwater under the island and measurements were made of the difference in water level between the bay and the ocean. In addition, shallow temporary wells were used to measure the elevation of the water table. The depth to the base of the freshwater lens was over-predicted by calculations of the static-equilibrium depth to a sharp interface apparently because of the sensitivity of the calculation to the low water-table elevations which are in turn sensitive to variations in sea level because of the existence of a transition zone between fresh and saline groundwater. Mixing and recirculation of saline groundwater at the base of the lens produced a transition zone up to 9.65 m thick. Measurements also support model forecasts of a mean bay level several centimeters above sea level, augmented by atmospheric forcing and wave setup. A time lag of about 8 hours between the response of the ocean level to longshore winds and the corresponding response of the bay level can result in a difference in elevation between the bay and the ocean that is up to four times that produced by other agents such as Stokes transport and density differences. In the presence of differential hydraulic head, bay and ocean water may be exchanged via groundwater flow between the base of the freshwater lens under the barrier beach and a deeper clay layer. The observations illustrate: (1) the size and shape of the freshwater lens can show substantial differences from theoretical predictions; (2) the recirculation of saltwater could be an important component of the total seepage across the sea floor; and (3) water level differences between the bay and ocean have the potential for driving an independent flow of saline groundwater. (Author's abstract)
W91-06954

INTERANNUAL PATTERNS OF WATER TABLE HEIGHT AND GROUNDWATER DERIVED NITRATE IN NEARSHORE SEDIMENTS.
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. G. Capone, and J. M. Slater.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 277-288, 1990. 7 fig, 9 ref. NSF Division of Ocean Sciences Grants OCE 84-17595 and 85-15886.

Descriptors: *Aquatic soils, *Groundwater movement, *Nearshore processes, *Nitrates, *Sediments, *Water level fluctuations, *Water table, Bays, Chemical properties, Cores, Denitrification, Interstitial water, Nitrogen compounds, Precipitation, Salinity, Seasonal variation.

Nitrate concentration and microbial nitrogen transformations in groundwater-affected sediments of Great South Bay, NY were examined over several annual cycles. An attempt was made to relate the extent of groundwater derived nitrate in interstitial waters to factors likely controlling its discharge, namely rainfall and water table height. Nitrate concentrations are typically higher at 40 cm depth than at the surface, while salinity generally decreases with depth. Denitrification occurs through the sediment core and is organic substrate limited at depth while being nitrate limited near the sediment-water interface. Denitrification accounts for about 50% of the biological NO3(-) decrease between 40 and 15 cm depth interval. Above average rainfall in 1983-84 was reflected in an elevated water table as well as lower bay salinities. Conversely, very low rainfall occurred in 1985-86, and the water table reached an extreme low in Sept. 1986. The amounts of nitrate in the sediment column of the primary station varied directly with the water table height and, presumably, the discharge rate of enriched groundwater. The factors controlling the distributions of nitrate in these sediments may be summarized as follows: at low water table height, the combination of denitrification and low input of nitrate results in uniformly low NO3(-) concentrations; at intermediate rates of groundwater discharge, dilution, diffusion and denitrification presumably combine to create the atypical distributions of NO3(-) generally observed; and relatively high concentrations of nitrate occur throughout the sediment column at high flow due to dominance of advective flow relative to diffusion and a reduced ability of sediment associated denitrifiers to affect the overall concentrations of nitrate. (Agostine-PTT)
W91-06955

NUTRIENT COUPLINGS BETWEEN ON-SITE SEWAGE DISPOSAL SYSTEMS, GROUNDWATERS, AND NEARSHORE SURFACE WATERS OF THE FLORIDA KEYS.
Harbor Branch Oceanographic Institution, Inc.,

Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W91-06956

NITROGEN INPUTS TO A MARINE EMBAYMENT: THE IMPORTANCE OF GROUNDWATER.
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 5B.
W91-06957

REPORT OF FLUOROSIS IN THE UNITED STATES SECONDARY TO DRINKING WELL WATER.
Veterans Administration Wadsworth Medical Center, Los Angeles, CA.
For primary bibliographic entry see Field 5C.
W91-06958

OPTIMAL SPECTRAL BASE-FLOW ESTIMATION.
Mexican Inst. of Water Technology, Progreso.
For primary bibliographic entry see Field 2E.
W91-07034

ESTIMATION OF SHALLOW GROUNDWATER QUALITY IN THE WESTERN AND SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA.
San Joaquin Valley Drainage Program, Sacramento, CA.
W. C. Swain.
Technical Information Record, September 1990. 47 p, 1 fig, 2 tab, 9 ref, 5 append.

Descriptors: *Data collections, *Groundwater irrigation, *Groundwater quality, *San Joaquin Valley, *Water quality, Agriculture, Arsenic, Boron, California, Maps, Molybdenum, Salinity, Selenium.

Shallow groundwater quality information is required for the development and evaluation of shallow groundwater and agricultural drainage water management alternatives in the San Joaquin Valley Drainage Program. The 1.7 million acres in the western and southern San Joaquin Valley underlain by shallow groundwater within 20 feet of the ground surface. Water quality constituents elevated are salinity, arsenic, boron, molybdenum and selenium. Information has been developed for the purpose of supporting planning activities at the regional and subregional scale, rather than for site-specific purposes. There is a high degree of areal and vertical variability throughout the study area, and shallow groundwater quality can and does vary more than is shown in this report. Water quality information is presented in the form of maps, expressed as areas with ranges of concentration values for each constituent evaluated. The areal extent of the various mapping units are based upon available water quality data, surficial geology and physiography, depositional environments, sediment source areas, soils and irrigation, and drainage histories. Dissolved constituent concentrations throughout the study area range approximately three orders of magnitude between minimum and maximum values. Such variability occurs on a regional scale, with localized variability generally limited to a factor of two to three. Mapping specific dissolved constituents in shallow groundwater is limited to those which have been identified as confirmed or strongly suspected of limiting management options. As more information becomes available through ongoing studies and monitoring programs, additional constituents which affect the management of agricultural drainage water may be identified. (Lantz-PTT)
W91-07037

TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. CHAPTER B4: REGRESSION MODELING OF GROUND-WATER FLOW.
R. L. Cooley, and R. L. Naff.
Book 3: Application of Hydraulics, 1990. 232p, 35 fig, 8 tab, 23 ref, 8 append. Includes one 5-1/4 in. diskette of 'Regression Modeling of Ground-Water Flow, v. 2.0.

Descriptors: *Groundwater movement, *Mathematical analysis, *Mathematical models, *Model studies, *Regression analysis, Data interpretation, Finite difference methods, Groundwater discharge, Groundwater recharge, Hydrologic models, Statistical methods.

Scientists and engineers have been using groundwater flow models to study groundwater flow systems for more than 20 years. The basic modeling process seems to be relatively straightforward. Initially, a sound conceptual model is formed and is translated into a tractable, mathematical model. Contributing to (and following) this conceptualization process is the collection of field information, such as: (1) location and extent of hydrostratigraphic units, recharge areas, discharge areas, and system boundaries; (2) hydraulic head measurements; and (3) pumping discharges. These data form the basis for input to the flow model. Finally, the model is run, and the desired information such as head distribution or flux rates is extracted. However, people engaged in modeling usually observe that two pervasive problems considerably complicate the situation. One problem is that good, general methods of measuring (or computing) some of the variables that characterize the flow system and its geologic framework do not exist. The second problem relates to errors in the measurements and their propagation into model results. As a consequence of these two problems, measurement (or computation) of the necessary input variables, application of them to an adequate model, and calculation of the desired results to an acceptable accuracy generally are not possible. Other methods that recognize and deal with the problems of incompleteness and/or inaccuracy of data must also be applied. A basic methodology of multiple nonlinear regression has been developed in which the regression model is some type of groundwater flow model. The main body of the text is organized into six major sections: (1) an introduction that discusses the general topic of modeling groundwater flow; (2) since the specific optimization approach employed is regression this section is included to provide the student with the necessary statistical background material; (3) presents detailed material on linear and nonlinear regression; (4) applies the nonlinear regression method to the specific problem of developing a general finite difference model of steady-state groundwater flow; (5) statistical procedures are given to analyze and use general linear and nonlinear regression models; and (6) supplements to the preceding sections. (Lantz-PTT)
W91-07044

GEOHYDROLOGY AND SIMULATION OF GROUND-WATER FLOW IN THE'400-FOOT,' '600-FOOT,' AND ADJACENT AQUIFERS, BATON ROUGE AREA, LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
E. L. Kuniansky.
Water Resources Technical Report No. 49, 1989. 90p, 58 fig, 7 tab, 7 plates, 30 ref.

Descriptors: *Aquifers, *Geohydrology, *Groundwater movement, *Model studies, *Simulation analysis, Aquifer systems, Baton Rouge, Groundwater mining, Louisiana, Mississippi River Basin, Water level.

Population growth southeast of the industrial area of Baton Rouge, Louisiana, has resulted in new pumping centers in the '400-foot' and '600-foot' aquifers in the area. This development was evaluated by using a three dimensional groundwater flow model calibrated using water levels from 1940 to 1948, and potentiometric maps for May and October 1984. Through calibration, it was determined that subsidence may have reduced the conductance of clay beds that underlie the industrial district. Simulations indicate that < 1 in/yr of recharge in the outcrop area goes into the regional flow system. More than 95% of recharge in the outcrop area is discharged to streams with no permanent change in storage in the aquifer in the outcrop area. Simulated flow to or from the Mississippi River through the Mississippi alluvial aquifer is seasonal and dependent on river stage. Simulated flow into or out of the river to the aquifer was always < 500 cu ft/sec for the reach of the river between St. Francisville and New Orleans, Louisiana. Simulated vertical flux to the '400-foot' and '600-foot' aquifers recovers quickly from the effects of pumpage because of the proximity of the outcrop area and the Mississippi River. The Baton Rouge fault, which is a barrier to groundwater flow in the deeper aquifers is a barrier to flow in the '400-foot' and '600-foot' aquifers west of the Amite River. Simulation of future pumpage in southeastern Baton Rouge indicates declines of 40-60 feet from the simulated water levels of the undeveloped aquifers and about 20 feet from the simulated 1984 water levels. (Lantz-PTT)
W91-07047

GEOHYDROLOGY AND WATER QUALITY OF STRATIFIED-DRIFT AQUIFERS IN THE EXETER, LAMPREY, AND OYSTER RIVER BASINS, SOUTHEASTERN NEW HAMPSHIRE.
Geological Survey, Bow, NH. Water Resources Div.
R. B. Moore.
Available from Books and Open Files Reports Section, USGS Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 88-4128, 1989. 61p, 29 fig, 3 tab, 8 plates, 28 ref.

Descriptors: *Aquifers, *Geohydrology, *Groundwater quality, *New Hampshire, *Water quality, Aquifer systems, Arsenic, Chlorides, Chromium, Exeter River Basin, Groundwater recharge, Heavy metals, Iron, Lamprey River Basin, Mercury, Model studies, Oyster River Basin, Sodium, Volatile organic compounds, Water analysis.

An investigation was conducted by the US Geological Survey (USGS) in cooperation with the State of New Hampshire Department of Environmental Services, Water Resources Division to describe the geohydrology and water quality of stratified-drift aquifers in the Exeter, Lamprey, and Oyster River Basins of southeastern New Hampshire. Characteristics of stratified drift materials that affect groundwater storage and movement are related to the original glaciofluvial environment in which they are deposited. The geohydrology of stratified-drift aquifers was investigated by focusing on basic aquifer properties, including: aquifer boundaries; recharge, discharge, and direction of groundwater flow; saturated thickness and storage; and, transmissivity. Two aquifer areas, West Epping and Newmarket Plains, were selected to evaluate the use of superposition technique in conjunction with a digital flow model. The results demonstrate that the amount of water that potentially is available is greatest in aquifers where induced infiltration from streams occurs. The sizes of the areas of contribution to wells estimated using the model results are 1.7 sq mi for the West Epping aquifer and 0.38 sq mi for the New Market Plains Aquifer. Water samples from 38 test wells and 2 springs were collected and analyzed to assess background water quality within the aquifers. Known areas of contamination were avoided, including three sites that are on the National Priority List of Hazardous Waste sites. Results of the sampling program show that water in the stratified aquifer generally meets US EPA drinking water regulations and recommended limits, with some exceptions. One sample had a 280 mg/L chloride concentration and 12 samples had sodium concentrations that exceeded 20 mg/L (mainly from road salt); 5 samples had iron concentrations > 1,000 micro g/L, and 27 samples had manganese concentrations that > 50 micro g/L (of natural origin). Other evidence of possible degraded groundwater conditions include one sample with a chromium concentration of 50 micro g/L, one sample with a mercury concentration of 4 micro g/L, two samples with elevated arsenic concentrations of 14 and 11 micro g/L, and one sample with detectable concentrations of volatile organic compounds. (Lantz-PTT)
W91-07050

EFFECTS OF HETEROGENEOUS POROUS GEOLOGY ON GROUNDWATER FLOW AND TRANSPORT MODELING IN MULTIAQUIFER SYSTEMS.
Savannah River Lab., Aiken, SC.
D. E. Stephenson.
Available from the National Technical Information Service, Springfield, VA 22161, as DE89-010442. Price codes: A03 in paper copy, A01 in microfiche. Report No. DP-MS-88-59, 1989. 25p, 18 fig, 1 tab, 18 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater movement, *Heterogeneity, *Model studies, *Path of pollutants, *Solute transport, Data interpretation, Flow profiles, Hydrologic models, Lithology, Mathematical models, Porosity, Savannah River Plant, Soil properties, South Carolina.

A multiaquifer groundwater flow system occurs in the Coastal Plain sediments underlying the Savannah River Plant (SRP) in South Carolina. Four predominantly silty or clayey beds divide these sediments into a sequence of five aquifers and four aquitards. In the past, these units have generally been considered to be areally continuous for modeling purposes. However, recent geologic investigations suggest the existence of small-scale variations in the lithology and continuity of the aquitards. A three-dimensional model was used to investigate the influence of simple heterogeneities and discontinuities in an aquitard on groundwater flow and transport in a 17 sq mi region of SRP where geologic and hydrologic control exists. Simple holes and faults in the confining bed were studied. These features produced variations in the distribution of hydraulic heads that could be difficult to detect without closely spaced monitoring wells in the vicinity of the feature. In terms of solute transport, however, significant changes in flow directions and rates resulted from the presence of the feature. The simulations showed that such heterogeneities and discontinuities can reverse flow directions near the feature and significantly reduce contaminant travel times to lower aquifers. The results of these model simulations indicate the importance of adequate geologic control for the accurate prediction of groundwater flowpaths in multiaquifer systems with implications for groundwater monitoring strategies, remedial system design, and risk assessments. (Lantz-PTT)
W91-07053

EFFECT OF IRRIGATED HORTICULTURAL CROPPING ON GROUNDWATER QUALITY: SWAN COASTAL PLAIN, WESTERN AUSTRALIA.
Agricultural Research Service, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 5G.
W91-07055

2G. Water In Soils

ALTERATION OF SOIL ORGANIC MATTER BY INUNDATION.
Irkutskii Gosudarstvennyi Univ. (USSR). Inst. of Petrochemical and Coal-Chemical Synthesis.
V. A. Seryshev, G. V. Ratovskiy, Y. V. Nazarova, N. A. Ivanova, and N. V. Serysheva.
Soviet Soil Science SSSCAE, Vol. 21, No. 4, p 45-58, 1989. 4 tab, 41 ref.

Descriptors: *Flooding, *Soil chemistry, *Soil organic matter, *USSR, Bratsk Reservoir, Chemical properties, Decomposing organic matter, Humic acids, Nitrogen, Soil analysis, Soil water.

The composition of humus in temporarily and constantly inundated auromorphic soils of the Ust-Ilim and Bratsk reservoirs and buried inundated soils of Proval Bay in Lake Baikal, USSR, was investigated to determine the composition of soil organic matter and the nature of its alteration in subaqueous conditions. As a result of inundation, the soil organic matter acquired several irreversible properties: the carbon content of humic acids decreased and their degree of oxidation increased; the percentage of carbon in the humic acid molecule decreased as the percentage of nitrogen increased. During inundation, the hydrolyzable components were split off from humic acid molecules, CH(2) and CH(3) groups were lost and the percentage of the most highly aromatic humic acids increased. (Author's abstract)
W91-05978

EFFECT OF WETTING AND DRYING ON THE SOIL STRUCTURE.
Moscow State Univ. (USSR). Dept. of Soil Science.
V. I. Makeyeva.
Soviet Soil Science SSSCAE, Vol. 21, No. 4, p 81-89, 1989. 3 fig, 2 tab, 13 ref.

Descriptors: *Irrigation effects, *Soil compaction, *Soil structure, *Soil water, *Soils, *USSR, Humic acids, Soil chemistry, Soil physics, Soil porosity.

The processes of periodic wetting and drying of soils from the Black Meadow and Chernozem, USSR, were studied to determine the cause of soil compaction and to predict the effect of prolonged use of irrigation. Swelling and shrinking are dependent upon the structural condition of the soil; the better structured the soil, the less it swells and shrinks compared to structureless soil. Periodic wetting and drying contributes to the formation of aggregates in the structureless soil due to numerous cracks which are formed in the course of drying and cause it to separate into individual fragments. This process causes a decrease in the total active surface of the soil and in its relative swelling from one cycle to another. Prolonged periodic wetting and drying of the upper 2 cm layer of black compact Meadow soil leads to the formation of a mulch layer which consists of aggregates 3-5 mm in diameter and reduces water loss from underlying horizons of the soil. The moisture content of lower horizons of black compact Meadow soil varies between 12 and 27%. At this moisture content the action of various forces, which impart maximum stability to the soil mass, is greatest. Improper irrigation of Chernozems at high moisture levels causes the soil to become thixotropic. Systematic mechanical cultivation of the soil at intolerable moisture limits causes a structure deterioration and may eventually lead to appreciable compaction of the soils when dehydrated. (Author's abstract)
W91-05979

EFFECT OF THE COMPOSITION OF SOIL SOLUTIONS AND EXCHANGE CATIONS ON WATER RETENTION AND HYDRAULIC CONDUCTIVITY.
Institute of Applied Physics, Pushkino (USSR).
Y. A. Pachepskiy.
Soviet Soil Science SSSCAE, Vol. 21, No. 4, p 90-103, 1989. 4 fig, 2 tab, 29 ref.

Descriptors: *Hydraulic conductivity, *Soil chemistry, *Soil solution, *Soil structure, Calcium, Cation exchange, Chlorides, Clay minerals, Model studies, Permeability coefficient, Sodium.

Additional swelling and water retention and the decrease of the permeability coefficient from Ca(2+)-saturated samples to samples in the mixed Ca-Na form depend mainly on the average thickness of the hydrate-ion layers in the interlayer spacings of smectite minerals. The hypothesis that the change in the water retention and hydraulic conductivity of soils is determined by the swelling of clay minerals if the solution in large pores is not excessively demineralized, is investigated to determine the limits of applicability and to find working formulas for its practical use. The investigations were performed for salinization with hydrolytically neutral salts using soil samples affected by calcium and sodium chlorides. The thickness of hydrate-ion layers in the interlayer spacings of smectite minerals can be calculated from formulas derived from the cation-separation and tactoid models. The degree of swelling of the clay fraction, water retention and the permeability coefficient in soils affected by sodium and calcium chlorides depend mainly on the thickness of the hydrate-ion layers at an ionic strength of the solution exceeding 0.003 mol/liter (a concentration greater than 0.11-0.17 g/liter). These relationships are affected by the content of smectite minerals in the clay fraction, by particle-size composition and by the content of strengthening components in the solid phase. (Author's abstract)
W91-05980

DETERMINATION OF CRITICAL MOISTURE CONTENTS OF SOILS IN THE COURSE OF EVAPOTRANSPIRATION.
Slovenska Akademia Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky.
For primary bibliographic entry see Field 2D.
W91-05981

ELUTION OF ENDRIN THROUGH COMPACTED SOIL WITH ETHANOL-WATER MIXTURES.
Trevecca Nazarene Coll., Nashville, TN.
For primary bibliographic entry see Field 5B.
W91-06021

DROUGHT-INDUCED ACCUMULATION OF NITRATE IN GRAIN SORGHUM.
Arkansas Univ., Hope. Southwest Research and Extension Center.
M. L. May, J. M. Phillips, and G. L. Cloud.
Journal of Production Agriculture, Vol. 3, No. 2, p 238-241, 1990. 1 fig, 2 tab, 15 ref.

Descriptors: *Agricultural engineering, *Drought effects, *Nitrates, *Soil-water-plant relationships, Cattle, Crop damage, Fertilizers, Grain crops, Plant growth, Sorghum.

Nitrate accumulation in crop plants is intensified by stress from inadequate moisture, but little information is available about the effect of N fertilization rate on NO3 accumulation in sorghum during a dry period. During the summer drought of 1988, NO3 concentrations in Funks G-522 DR grain sorghum receiving 0 to 150 lb N/acre as NH4NO3 were measured over five harvests (cutting height 6-in above the soil surface), which simulated salvage of a grain crop for animal feed. The objectives of the study were to determine the effects of N fertilization rate on NO3 and dry matter accumulation as well as total N uptake of grain sorghum. Sorghum was seeded 26 April on a Bowie fine sandy loam soil (fine-loamy, siliceous, thermic Plinthic Paleudults). When sampled on 23 June, NO3 concentration in sorghum tissue was equal to the 2100 ppm NO3-N concentration that could be lethal to cattle (Bos taurus, Bos indicus) where 50 lb N/acre had been applied, and increased as N fertilizer rate increased up to the 100 lb N/acre rate (2160, 4280, and 5360 ppm NO3-N for 50, 100, and 150 lb N/acre, respectively, at growth stage 5, or boot state). When harvested for animal feed on 26 July (growth stage 7, soft dough), the sorghum was safe for consumption by cattle. Percent total N in sorghum tissue increased as N fertilizer rate increased, and dry matter accumulation averaged approximately 7700 lb/acre at growth stage 7. Based on the observations from this study, sorghum producers who consider salvaging a grain crop at the boot growth stage should test the forage for NO3 content if drought conditions exist. (Author's abstract)
W91-06300

MEASUREMENT OF WATER USE AND PASTURE GROWTH ON TEMPLETON SILT LOAM.
Canterbury Agriculture and Science Centre, Lincoln (New Zealand).
R. J. Martin.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 33, No. 2, p 343-349, 1990. 4 fig, 1 tab, 15 ref.

Descriptors: *Evapotranspiration, *New Zealand, *Pastures, *Soil moisture deficiency, *Soil water, *Soil-water-plant relationships, Crop production, Dry matter, Evapotranspiration potential, Pasture management, Soil profiles.

Pasture growth in Canterbury, New Zealand, is frequently restricted by inadequate soil moisture levels. To prevent the development of soil moisture conditions which will have an adverse effect on pasture production, farmers need to know the soil water deficit at which pasture growth is restricted, either by direct measurement or by a water budget which has preferably been calibrated to a measured water deficit. Soil water contents to a depth of 1.05 m and pasture growth were measured over three years on irrigated and dryland perennial ryegrass-white clover pasture on a Templeton silt loam soil near Christchurch, New Zealand. Cumulative dry matter (DM) yield was linearly related to cumulative Penman potential evapotranspiration when soil moisture deficits in the top 1.05 m of soil were less than 90 mm, and averaged 11.3 kg DM/ha per mm potential evapotranspiration. Growth was slower for soil moisture deficits between 90 and 160 mm, and stopped at greater deficits. The maximum soil moisture deficit obtained in a very dry year was 190 mm. Soil moisture extraction occurred mainly from the top 450-600 mm of soil at low water deficits. As the soil dried, progressively more moisture was taken up from lower down the profile. Yields were reduced at smaller soil water deficits than transpiration. (Author's abstract)
W91-06307

SOIL WATER DYNAMICS, TRANSPIRATION, AND WATER LOSSES IN A CRESTED WHEATGRASS AND NATIVE SHORTGRASS ECOSYSTEM.
Colorado State Univ., Fort Collins. Dept. of Range Science.
For primary bibliographic entry see Field 2I.
W91-06314

PROTON CYCLE OF A DECIDUOUS FOREST ECOSYSTEM IN THE NETHERLANDS AND ITS IMPLICATIONS FOR SOIL ACIDIFICATION.
Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science.
For primary bibliographic entry see Field 5B.
W91-06317

SOIL WATER ASSESSMENT MODEL FOR SEVERAL CROPS IN THE HIGH PLAINS.
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
J. M. Robinson, and K. G. Hubbard.
Agronomy Journal AGJOAT, Vol. 82, No. 6, p 1141-1148, November/December 1990. 5 fig, 5 tab, 27 ref.

Descriptors: *Agricultural engineering, *Crops, *Hydrologic models, *Model studies, *Soil water, *Soil-water-plant relationships, Corn, Evapotranspiration, Hydrologic budget, Meteorological data, Root zone, Soil horizons, Sorghum, Soybeans, Wheat.

Soil properties, soil water content, and precipitation vary widely within the High Plains of the US. Reliable estimates of crop water status have been hampered by a general sparsity of soil water monitoring. This study examined the feasibility of determining soil water status using a soil water balance model. Soil water content was measured under corn, wheat, sorghum, and soybean at different sites in the High Plains during 1986 and 1987. Surface weather data collected from the High Plains Automated Weather Data Network served as input to a model that estimates evapotranspiration and soil water content on a daily time step. Atmospheric demand was represented by potential evapotranspiration calculated from the Penman method. Model estimates of total water in the root zone were compared to measured values using statistical measures including the index of agreement. Comparison at one site between measured and estimated soil water by individual soil layers beneath a corn crops indicated that water content was slightly underestimated in the upper layers and overestimated in the lower layers. The performance of the model in estimating total soil water over a range of soil types, crops, and weather was satisfactory, with the majority of index of agreement values exceeding 0.75. Based on the results of this study, it was concluded that it is now possible to accurately estimate soil water conditions in a timely fashion under reasonably flat terrain, provided near-real time weather data are available. (Author's abstract)
W91-06399

ESTIMATING THE ATTERBERG LIMITS OF SOUTHERN SASKATCHEWAN SOILS FROM TEXTURE AND CARBON CONTENTS.
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 8D.
W91-06405

GRAZING IMPACTS ON INFILTRATION IN MIXED PRAIRIE AND FESCUE GRASSLAND ECOSYSTEMS OF ALBERTA.
Alberta Univ., Edmonton. Dept. of Soil Science.
For primary bibliographic entry see Field 4C.
W91-06406

INFLUENCE OF AGGREGATE DIAMETER, SURFACE AREA AND ANTECEDENT WATER CONTENT ON THE DISPERSIBILITY OF CLAY.
Guelph Univ. (Ontario). Dept. of Land Resource Science.
B. D. Kay, and A. R. Dexter.
Canadian Journal of Soil Science CJSSAR, Vol. 70, No. 4, p 655-671, November 1990. 6 fig, 5 tab, 25 ref.

Descriptors: *Antecedent moisture, *Australia, *Clay soils, *Soil aggregates, *Soil properties, *Soil science, *Soil water, Aggregates, Clays, Dispersion, Farm management, Soil management, Soil stability.

Dispersible clay influences a range of physical and mechanical properties of soils, and values of dispersible clay should be included in assessments of new soil, crop, and water management practices. The percentages of spontaneously-dispersed clay and mechanically-dispersed clay in a suspension of a given ionic strength were hypothesized to be controlled by the specific area of exposed aggregate surfaces and the dispersibility of clay per unit specific aggregate surface area. This hypothesis was evaluated using different-sized aggregates collected in 1988 from wheat-fallow and continuous pasture rotations established in 1925 on a red-brown earth in southern Australia. Aggregates which were initially air-dry were wetted to matric water potentials ranging from -10 to -0.3 kPa, then placed in distilled water and percentages of spontaneously-dispersed and mechanically-dispersed clay measured. Amounts of spontaneously-dispersed clay increased, as hypothesized, with increasing surface area of aggregates. However, the spontaneously-dispersed clay per unit surface area of aggregates increased with increasing size of aggregates and increasing antecedent soil water content. The effect of water content was greatest in the larger aggregates of the less stable wheat-fallow soil. Mechanically-dispersed clay was approximately 12 times larger than spontaneously-dispersed clay and increased with increasing initial aggregate size and increasing antecedent water content. The sensitivity of mechanically-dispersed clay to water content was greatest on the least stable soil. Calculations showed that the higher values of mechanically-dispersed clay on unstable soils were due to both larger exposed aggregate surface areas and higher dispersibility of the clay on these surfaces. (Author's abstract)
W91-06407

IRRIGATION SUITABILITY OF SOLONETZIC SOILS IN THE COUNTY OF NEWELL, ALBERTA.
Alberta Agriculture, Lethbridge. Land Evaluation and Reclamation Branch.
For primary bibliographic entry see Field 3F.
W91-06409

VERTICALLY INSTALLED, FLUSH-MOUNTED TENSIOMETER FOR TURFGRASS RESEARCH.
Kansas State Univ., Manhattan. Dept. of Horticulture.
For primary bibliographic entry see Field 7B.
W91-06413

MEASUREMENT OF SOIL WATER POTENTIAL.
Gulf Coast Research and Education Center, Bradenton, FL.
G. A. Clark.
Horticultural Science, Vol. 25, No. 12, p 1548-1551, December 1990. 18 ref.

Descriptors: *Instrumentation, *Measuring instruments, *Soil science, *Soil water, *Soil water potential, Energy equation, Tensiometers, Thermal conductivity, Thermocouples.

Total soil water potential includes pressure, gravimetric, and osmotic components. Measurement of gravimetric potential is relatively easy because it is referenced to a fixed datum. Unsaturated pressure potentials and osmotic potentials are more difficult to measure. Generally, another property of the soil is measured and calibrated to the water potential, or a reference matrix is used to equilibrate with the soil and then a property of that reference matrix is measured. Common devices used for measuring soil water potential include tensiometers, electrical resistance blocks, heat pulse (or thermal conductivity) sensors, and thermocouple psychrometers. Soil water potential represents the static energy state of soil water and its potential energy. Movement of water within the soil is slow; thus, the other form of energy, kinetic, is considered to be negligible. Soil water potential is considered to be the 'total' energy level with respect to the energy state of soil water and is generally expressed in terms relative to water in a standard reference state. (Author's abstract)
W91-06415

SIMPLE WATER-BALANCE MODELS FOR SIMULATING MOISTURE, SALINITY AND SODICITY PROFILES IN SOILS UNDER WHEAT.
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 3F.
W91-06418

PERMEABILITY OF FROZEN AND THAWED SOILS AND SUB-SOILS DURING SPRING SNOWMELT FLOOD.
Gosudarstvennyi Gidrologicheskii Inst., Valdai (USSR).
For primary bibliographic entry see Field 2C.
W91-06465

STUDY ON THE EFFECT OF CHANGES OF GROUNDWATER LEVELS ON SOIL MOISTURE CONDITION AND EVAPOTRANSPIRATION.
Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology.
For primary bibliographic entry see Field 2F.
W91-06488

TESTS AND APPLICATION OF SOIL MOISTURE DEFICIT MODELS USED FOR ANALYSIS OF BASIN BEHAVIOUR.
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
For primary bibliographic entry see Field 2E.
W91-06489

ROOT ZONE DRAINAGE FROM A HUMID FOREST SOIL IN THE WEST COAST OF CANADA.
British Columbia Ministry of Forests, Kamloops. Hydrology Research Section.
J. D. Cheng.
IN: Forest Hydrology and Watershed Manage-

ment. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 377-386, 4 fig, 1 tab, 12 ref.

Descriptors: *Forest hydrology, *Forest soils, *Forest watersheds, *Root zone, *Soil water, British Columbia, Canada, Drainage, Evapotranspiration, Hemlock trees, Hydraulic conductivity, Hydrologic budget, Hydrologic equation, Lysimeters, Rainfall, Rainfall-runoff relationships, Surface runoff.

The hydrologic processes taking place within the root zone control or influence the amounts and rates of water movement to stream channels, the leaching of soluble nutrients, and the effects of forest operations on these parameters. The root zone water balance of a forest soil can be expressed in terms of rainfall, evapotranspiration, surface runoff, change in soil water content, and drainage. A study was conducted to determine and compare the drainages from the root zone of a humid forest soil using two simple and inexpensive methods: (1) Darcy's equation with required data determined in situ; and (2) an unconfined type tension lysimeter system modified to allow manual adjustments of suction on the lysimeter plate according to the tensions in the soil. Root zone drainage from the Jamieson Creek watershed in southwestern British Columbia and within the wetter subzone of the coastal western hemlock biogeoclimatic zone was evaluated. Suction on the lysimeter plate, which had improved hydraulic contact with the soil, was adjusted according to the tension in the surrounding soil. Field-determined soil hydraulic conductivity and hydraulic gradient data were used in the Darcy's equation method. Drainages measured by the two methods were similar with the lysimeter method giving slightly higher values, and drainage amounts during two drying periods agreed well with those estimated from a water balance method. The variations of root zone drainage were closely related to those of rainfall and streamflow of the small surrounding watershed. Human and/or systematic errors may be corrected by making necessary improvements, e.g., utilizing more expensive automatic recording equipment and control devices. (See also W91-06510) (Fish-PTT)
W91-06546

SOIL WATER BALANCE MODEL FOR PARTITIONING WATER USE AMONG CROP TREES, EVAPORATION, AND COMPETING VEGETATION.
Oregon State Univ., Corvallis. Dept. of Soil Science.
S. W. Childs, C. Costello, and A. L. Flint.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 387-399, 5 fig, 3 tab, 20 ref.

Descriptors: *Forest hydrology, *Forest watersheds, *Model studies, *Reforestation, *Soil water, *Soil-water-plant relationships, *Watershed management, Evapotranspiration, Forest soils, Hydrologic budget, Hydrologic equation, Land management, Seedlings, Sensitivity analysis.

Soil water balance information is routinely used to analyze and plan reforestation operations after timber harvest; soil water storage, evapotranspiration, and timing all must be considered when evaluating the likelihood of reforestation success. Land managers need techniques to evaluate large numbers of reforestation sites. The detailed approaches of currently available soil water balance models require too much site specific data for routine use. A soil water balance model was developed to simulate the processes that affect moisture conditions for seedling growth and survival, by calculating the soil water balance given input measurements or estimates of climate, soil properties, and vegetative cover conditions. The input data requirement was kept to a minimum in order to maximize the utility of the model in situations where few measurements are available. The model was tested for use in four common reforestation environments (shading, mulching, vegetation control, and no treatment) where competing vegetation and soil surface evaporation may reduce soil water supply below that needed for seedling survival. The verification experiment showed that the model can calculate the measured treatment differences found in a detailed soil water balance study. A sensitivity analysis of the model showed the model was not overly sensitive to errors in estimating soil properties and cover percentages. The model was sensitive to climate inputs but no more so than the soil water balance itself. The modeling technique is recommended as a method for assessing the probability of seedling water supply limitations given a historical data set from or near a given site. (See also W91-06510) (Fish-PTT)
W91-06547

PRELIMINARY ASSESSMENT OF SOIL HYDRAULIC PROPERTIES, AND THEIR IMPLICATIONS FOR AGRO FORESTRY MANAGEMENT IN GRENADA, WEST INDIES.
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
J. L. Ternan, A. G. Williams, and K. Solman.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 409-421, 4 fig, 2 tab, 23 ref.

Descriptors: *Forest hydrology, *Forest watersheds, *Grenada, *Hydraulic properties, *Land use, *Soil erosion, *Soil properties, *Soil water, *Tropical regions, *Watershed management, Forest soils, Grasslands, Hydraulic permeability, Land management, Runoff, Soil analysis, Soil density, Soil horizons, Soil porosity, Throughfall, West Indies.

In parts of the tropics such as Grenada much of the natural forest has long since been replaced by various types of tree vegetation ranging from semi-natural secondary forest to mixed plantation crops. Pressure to make such land more productive for food, cash crops, or timber requires information on runoff processes in these disturbed but well-vegetated areas, as well as an assessment of the possible impact of planned land-use changes on runoff and erosional processes. Because of a lack of flow data for Grenadian rivers and limited time and resources available, attention was focused on a reconnaissance investigation into soil hydraulic properties in the Annandale basin, and the implications of these results for management. Soil texture, bulk density, air capacity, and soil permeability at six sites showed considerable variations between sites and within profiles. Differences between sites can be related to variations in land use, site position, and geomorphic history, and eluviation processes within the profile. Near-surface horizons were characterized by low bulk density, high air capacity, and high permeability (>2.7 m/day). Subsurface horizons have restricted permeability (<1.5 m/day) and low air capacity. Saturated throughflow at shallow depths is considered likely to be the major storm runoff-generating process. Measurements in open scrub and grassland sites suggest that conversion from the present tree-based land use to open pasture is likely to have detrimental effects on runoff and soil erosion processes. (See also W91-06510) (Fish-PTT)
W91-06549

CONTRIBUTION OF BEDROCK GROUNDWATER FLOW TO STORM RUNOFF AND HIGH PORE PRESSURE DEVELOPMENT IN HOLLOWS.
California Univ., Berkeley. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W91-06575

EXPERIMENTAL STUDY ON THE PHENOMENA OF RAIN INFILTRATION.
National Research Center for Disaster Prevention, Sakura (Japan).
For primary bibliographic entry see Field 2B.
W91-06598

NITRATE TRANSPORT AND LEACHING MECHANISMS.
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W91-06736

LINKAGES WITH GROUND WATER.
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2F.
W91-06743

PH DEPENDENT ACCUMULATION OF PCP IN AQUATIC MICROCOSMS WITH SEDIMENT.
Ohio State Univ., Columbus. Dept. of Entomology.
For primary bibliographic entry see Field 5B.
W91-06748

EFFECTS OF SOIL FAUNA ON LEACHING OF NITROGEN AND PHOSPHORUS FROM EXPERIMENTAL SYSTEMS SIMULATING CONIFEROUS FOREST FLOOR.
Jyvaeskylae Univ. (Finland). Dept. of Biology.
For primary bibliographic entry see Field 2K.
W91-06786

DENITRIFICATION WITH DIFFERENT SIZES OF SOIL AGGREGATES OBTAINED FROM DRY-SIEVING AND FROM SIEVING WITH WATER.
Guelph Univ. (Ontario). Dept. of Land Resource Science.
E. G. Beauchamp, and A. G. Seech.
Biology and Fertility of Soils BFSOEE, Vol. 10, No. 3, p 188-193, 1990. 4 fig, 3 tab, 23 ref.

Descriptors: *Denitrification, *Sieve analysis, *Soil aggregates, *Soil analysis, Carbon, Limiting factors, Loam, Mineralization, Particle size, Soil organic matter, Soil water, Spatial variation, Variability.

The spatial variability of denitrification in soil in the field is of interest since measurements in the field are highly variable even within distances of a few centimeters, and an understanding of the variability may assist in discerning the relative importance of limiting factors such as the organic carbon (C) supply. The spatial variability of denitrification in soil was studied by comparing dry-sieved and wet-sieved aggregates of different sizes. It was observed that the denitrification rate generally decreased as the dry-sieved aggregate size increased. In contrast, the denitrification rate increased as the wet-sieved aggregate size increased. In both cases, however, the denitrification rate was positively related to aerobically mineralizable carbon. Oven-warming of the wet-sieved aggregates at 105 C for 30 minutes increased the denitrification rate, apparently due to the release of C substrate. Nevertheless, the positive relationship between the denitrification rate and the wet-sieved aggregate size persisted. There was no clear relationship between water-soluble C and the denitrification rate. There may have been a contribution from C in microbial polysaccharides in aggregates of different sizes. The results demonstrated that there was a large spatial variability in denitrification over short distances in soil, which was associated with aggregates of different sizes and water stability. (Author's abstract)
W91-06787

SOIL ELECTRICAL CONDUCTIVITY: EFFECTS OF SOIL PROPERTIES AND APPLICATION TO SOIL SALINITY APPRAISAL.
Agricultural Research Service, Riverside, CA. Salinity Lab.
J. D. Rhoades, and D. L. Corwin.
Communications in Soil Science and Plant Analysis CSOSA2, Vol. 21, No. 11/12, p 837-860, 1990. 12 fig, 1 tab, 11 ref.

Descriptors: *Conductivity, *Model studies, *Saline soils, *Soil physical properties, *Soil water, California, Clays, Correlation analysis, Estimating, Field tests, Mapping, Model testing, Pore size, Salinity, Salts, Soil density, Soil surveys.

A model was developed which relates bulk soil electrical conductivity to volumetric water content, electrical conductivity of the soil water, volumetric content of the solid phase and average electrical conductivity of the soil particles. Within the model a distinction is made between the water and dissolved salt present in the 'immobile' (fine pores) and 'mobile' (large pores) phases. The effects of bulk density, particle density and clay content upon bulk soil electrical conductivity are discussed in relation to their influence upon volumetric water content, volumetric content of the solid phase, electrical conductivity of the soil particles and the proportions of fine and large pores. The practical application of the model to interpret soil salinity requires that estimation of several soil properties in the field and the use of some empirical relationships to estimate values of parameters required by the model. The results support the utility of the model as an explicit description of electrical conductivity in soil and as a practical field salinity appraisal tool. The model was used for diagnosing and mapping soil salinity in an intensive field study (more than 700 sites tested) in the San Joaquin Valley of California. A high correlation between predicted and measured salinity magnitude and distribution within the study area was seen. Where the differences were large, the salinity levels were so high as to make them agriculturally unimportant. (Author's abstract)
W91-06789

DEGRADATION OF DIFLUBENZURON AND ITS CHIEF METABOLITES IN SOILS PART III: FATE OF 2,6-DIFLUOROBENZOIC ACID.
Duphar B.V., The Hague (Netherlands). Crop Protection Div.
For primary bibliographic entry see Field 5B.
W91-06792

LEACHING POTENTIAL AND DECOMPOSITION OF FLUROXYPYR IN SWEDISH SOILS UNDER FIELD CONDITIONS.
Sveriges Lantbruksuniversitet, Uppsala. Div. of Water Management.
For primary bibliographic entry see Field 5B.
W91-06794

DEGRADATION OF PENDIMETHALIN BY SOIL FUNGI.
Bidhan Chandra Krishi Viswa Vidyalaya, Mohanpur (India). Dept. of Agricultural Chemistry and Soil Science.
For primary bibliographic entry see Field 5B.
W91-06795

FIELD MOVEMENT AND PERSISTENCE OF FENAMIPHOS IN DRIP-IRRIGATED PINEAPPLE SOILS.
Hawaii Univ. at Manoa, Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 5B.
W91-06797

DISSIPATION OF FLURTAMONE IN THREE GEORGIA SOILS.
Georgia Univ., Athens. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W91-06828

EFFECTS OF SOIL PROPERTIES AND MOISTURE ON SORPTION OF TRICHLOROETHYLENE VAPOR.
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W91-06861

SPATIAL VARIABILITY OF AN AGRICULTURAL FIELD: GEOSTATISTICAL ANALYSIS OF SOIL TEXTURE, SOIL MOISTURE AND YIELD COMPONENTS OF TWO RAINFED CROPS.
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique de Grenoble.
J. Munoz-Pardo, P. Ruelle, and M. Vauclin.
Catena, Vol. 17, No. 4/5, p 369-381, August/October 1990. 4 fig, 4 tab, 14 ref.

Descriptors: *Crop yield, *Cultivated lands, *Error analysis, *Geostatistics, *Soil texture, *Soil water, *Soil-water-plant relationships, Crop production, Oats, Sampling, Spatial distribution, Statistical methods, Wheat.

Spatial variations of soil moisture content, textural components and yield components of two rainfed crops (vetch-oat and durum wheat) were studied by classical statistical and geostatistical tools. The measurements were made at 81 nodes of a 15 by 10 m grid superimposed on a 1.1 ha plot selected in a 13.5 ha-field. The variability of each variable is characterized by a coefficient of variation ranging from 11% to more than 100% and a range varying from a distance smaller than the sampling interval to about 80 m. The concepts of dispersion and estimation variances were used to estimate the accuracy of the calculated mean values and to derive the relation between the dimensions of the sampled plot and the number of measurements needed to estimate average values with a given pre-specified error. The results show that the total relative errors affecting the mean values calculated from 81 observations are in the range between 3 and 26% according to the variables, the major contribution arising from the finite character of the sampled plot. They also suggest that for the case where variables have spatial structure, decreasing the error on mean values cannot be achieved without increasing the size of the sampling surface. (Author's abstract)
W91-06906

SHRINKAGE OF DUTCH CLAY SOIL AGGREGATES.
Winand Staring Centre for Integrated Land, Soil and Water Research, Wageningen (Netherlands).
J. J. B. Bronswijk, and J. J. Evers-Vermeer.
Netherlands Journal of Agricultural Science NETMAW, Vol. 38, No. 2, p 175-194, 1990. 6 fig, 5 tab, 35 ref.

Descriptors: *Clay soils, *Soil aggregates, *The Netherlands, Climates, Drying, Shrinkage, Soil profiles, Soil water, Subsidence.

Shrinkage processes in clay soils are important because surface subsidence and shrinkage cracks have a large impact on transport processes in these soils and on their use potential. Of 7 representative clay soil profiles from the Netherlands, shrinkage characteristics and COLE (coefficient of linear extensibility) and PLE (potential linear extensibility) values were measured, using undisturbed natural aggregates. It appeared that the course of the shrinkage process upon drying varied strongly from one soil to another, and very often the measured shrinkage characteristics deflected from the theoretical curve. Some Dutch heavy clay soils belong to the strongest swelling and shrinking soils of the world, with volume decreases of aggregates being maximally 49% between saturation and oven-dryness, and maximally 42% between saturation and a pressure head of minus 16,000 cm. Potential surface subsidence of a Dutch field soil due to shrinkage is maximally 15 cm. Under Dutch climatic circumstances, in some heavy clay soils, as a result of normal shrinkage, the aggregates remain saturated throughout the whole year. Only interaggregate pores like shrinkage cracks contain air. (Author's abstract)
W91-06935

EFFECT OF DIFFERENT DRAINAGE SYSTEMS ON BEARING RESISTANCE OF SOME WEST COAST, SOUTH ISLAND SOILS.
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Div. of Land and Soil Sciences.
R. F. Thomas, G. Mew, and P. R. Barker.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 33, No. 3, p 479-488, 1990. 4 fig, 4 tab, 23 ref.

Descriptors: *Drainage effects, *Grazing, *New Zealand, *Pasture management, *Soil properties, Cattle, Drains, Fences, Peat soils, Productivity, Sheep, Soil types, Strength, Subsoil drains, Tile drains, Wetlands.

Development of extensive areas of West Coast, South Island (New Zealand) wetland soils into pasture has led to unacceptable levels of pugging and loss of pasture production when cattle are introduced following sheep grazing. A trial was established to test two main drainage systems, subsoiling and 'humps and hollows,' with several supplementary treatments including tile drains and gravel-filled slits. Measurements were made from 1983, before systems were installed, to 1987. General relationships were found between water content and plate-bearing resistance for each trial plot, and for all sites with Okarito soils. Soils underlain by Kini, Maimai, and Okarito soils with peaty topsoils had significantly lower plate-bearing resistance compared with Okarito soils with mineral topsoils on major interfluves, regardless of the drainage treatment applied. In the first year of installation, the driest parts of the hollows in the humps and hollows treatment (Okarito subsoil material) had very high bearing resistance. The trial data show that Okarito soils with mineral topsoils will withstand cattle treading without the additional drainage treatments attempted here. Detailed soil survey, with subsequent fencing and management to isolate areas with low bearing resistance, will lead to higher productivity on such soils. (Author's abstract)
W91-06937

SULFUR DYNAMICS IN MINERAL HORIZONS OF TWO NORTHERN HARDWOOD SOILS: A COLUMN STUDY WITH S35.
State Univ. of New York at Syracuse. Coll. of Environmental Science and Forestry.
B. R. Dhamala, M. J. Mitchell, and A. C. Stam.
Biogeochemistry BIOGEP, Vol. 10, No. 2, p 143-160, 1990. 6 fig, 4 tab, 45 ref.

Descriptors: *Acid rain, *Adirondack Mountains, *Forest soils, *Path of pollutants, *Radioisotopes, *Soil chemistry, *Soils, *Sulfur compounds, Analytical methods, Biogeochemistry, Leaching, Mineralization, Minerals, Organic compounds, Soil columns, Spodosols, Tracers.

Sulfur dynamics of two Spodosols were determined using soil columns constructed from homogenized mineral soil from northern hardwood ecosystems at the Huntington Forest (HF) in the Adirondack Mountains of New York and Bear Brook Watershed in Maine (BBWM). Columns were leached for 20 weeks with a simulated throughfall solution containing S35 labelled SO4(2-). Sulfur constituents were similar to those of other Spodosols, with the organic S fractions (C-bonded S and ester sulfate) constituting over 90% of total S. HF soil columns had higher total S than that for the BBWM soil columns, primarily due to higher C-bonded S in the HF columns. Initially, adsorbed sulfate accounted for 5% (BBWM) and 4% (HF) of total S for the soil columns. After 20 weeks, adsorbed sulfate decreased (81%) in BBWM and increased (33%) in HF soil columns. For both HF and BBWM, C-bonded S increased and ester sulfate decreased, but only for HF was there a net mineralization of organic S. The greatest decrease in ester sulfate occurred at the top of the columns. Leaching of S35 was less than 0.5% of the S35 added due to its retention in various S constituents. There was an exponential decrease in S35 with column depth and most of the radioisotope was found in C-bonded S. The rapid turnover of adsorbed sulfate was reflected in its high specific activity. The lower specific activity of adsorbed sulfate in HF was attributable to greater isotopic dilution by non-radioactive sulfate derived from greater organic S mineralization in the HF versus the BBWM columns. Leaching of nitrate and sulfate was correlated with losses of Mg(2+) and Ca(2+), of which the latter was the dominant cation. Results indicate that for BBWM columns, adsorption-desorption dominated the S biogeochemistry while in HF columns, organic S mineralization-immobilization processes were more important. (Author's abstract)
W91-06948

IMPORTANCE OF SOIL WATER CONTENT WHEN ESTIMATING SOIL MICROBIAL C, N AND P BY THE FUMIGATION-EXTRACTION METHODS.
New Zealand Soil Bureau, Lower Hutt.
G. P. Sparling, and A. W. West.
Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 2, p 245-253, 1989. 2 fig, 6 tab, 30 ref.

Descriptors: *Analytical methods, *Carbon, *Nitrogen, *Phosphorus, *Separation techniques, *Soil chemistry, *Soil water, Biomass, Chemical properties, Fumigation, Incubation, Mathematical studies, Microorganisms, Physical properties, Soils.

The influence of soil water content on the estimation of microbial C, N and P by the fumigation-extraction (FE) method and microbial C and N by the fumigation-incubation (FI) method was investigated using a range of air-dry soils. The estimates of microbial C were compared with those obtained by the substrate-induced respiration (SIR) method. Soils which were either air-dry or rewetted to 50% w/w water content were fumigated overnight with chloroform. The presence of water during fumigation greatly increased the C and N extracted by 0.5 M K2SO4 compared with soils fumigated while air-dry. Overnight rewetting of non-fumigated (control) soils decreased extractable-C but the effect on extractable-N was variable. Rewetting before fumigation also increased CO2-C production and net N-mineralization (during subsequent incubation) compared to soils fumigated while air-dry. However, because of high variability the increases were often not significant. The flushes of extractable-C and N (the difference between fumigated and non-fumigated soils) were calculated in three ways. Comparison with the biomass C estimated on air-dry soils by the SIR method suggests the most appropriate way to estimate the flush is: flush = (extractable-C from wetted, fumigated soil) minus (extractable-C from air-dry, non-fumigated soil). Estimates of microbial C varied by up to 5-fold depending on how the flush was calculated. The release of inorganic P by fumigation of air-dry soil was generally increased by rewetting. Releases were greatest from rewetted soil fumigated with chloroform vapor, lower when using liquid chloroform and usually lowest when air-dry soil was fumigated with vapor. To estimate microbial biomass C, N and P of air-dry or moisture stressed soils when using the FE or FI methods it is recommended that the soils be rewetted immediately before fumigation. (Author's abstract)
W91-06961

DENITRIFICATION IN NORTH TEMPERATE FOREST SOILS: RELATIONSHIPS BETWEEN DENITRIFICATION AND ENVIRONMENTAL FACTORS AT THE LANDSCAPE SCALE.
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
P. M. Groffman, and J. M. Tiedje.
Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 5, p 621-626, 1989. 6 fig, 2 tab, 33 ref.

Descriptors: *Denitrification, *Environmental effects, *Forest soils, *Soil chemistry, Analytical methods, Biological factors, Biomass, Extraction techniques, Fumigation, Mathematical studies, Microorganisms, Mineralization, Physical properties, Seasonal variation, Soil types, Soil water, Subsoil drainage.

The relationship between denitrification activity and microbial biomass is an unexplored area. Microbial biomass C and N contents are indicators of the amount of labile C and N in soil and are the integrative product of multiple physical and biological factors. They may be useful for indexing C availability and multifactor interactions that lead to differences in denitrification among different ecosystems. Relationships between annual denitrification N loss and soil physical and biological factors were investigated in nine north temperate forest soils of different texture and drainage classes. Soil texture was analyzed numerically by using sand as a variable and soil wetness was quantified by a continuous drainage function. Correlations between soil texture, soil drainage, microbial biomass C and N content, the ratio of the flush of C mineralization to the flush of N mineralization following fumigation (CfNf), denitrification enzyme activity (DEA), the ratio of DEA-to-biomass C, and annual denitrification N loss were quantified. The DEA and DEA-to-biomass C ratio accounted for up to 96% of the variation in annual denitrification N loss. Percentage sand and soil wetness also accounted for a large proportion of the annual variation in denitrification rates among sites. Very low rates of denitrification in wet sandy soils were related to high CfNf values. The ratio DEA-to-biomass C is an indicator of the proportion of the soil microbial population that can denitrify. Differences in this ratio among the soils studied suggest that there is a selective advantage to organisms with the ability to denitrify. By analyzing annual denitrification N loss and by evaluating landscape-scale factors, such as soil texture and drainage, it was possible to establish strong relationships between denitrification and environmental factors. (Author's abstract)
W91-06963

BIODEGRADATION OF SYNTHETIC ORGANO-METALLIC COMPLEXES OF IRON AND ALUMINUM WITH SELECTED METAL TO CARBON RATIOS.
Centre de Pedologie Biologique, Vandoeuvre-les-Nancy (France).
For primary bibliographic entry see Field 2K.
W91-06965

NITROGEN DYNAMICS OF SOIL WATER IN BURNED AND UNBURNED TALLGRASS PRAIRIE.
Kansas State Univ., Manhattan. Div. of Biology.
D. C. Hayes, and T. R. Seastedt.
Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 8, p 1003-1007, 1989. 4 fig, 4 tab, 24 ref.

Descriptors: *Fire effects, *Grasslands, *Nitrogen, *Nitrogen cycle, *Prairie fires, *Prairies, *Soil water, Chemical properties, Moisture meters, Precipitation, Soil chemistry, Subsurface water, Watersheds.

The importance of fire in influencing the patterns and concentrations of N in the soil was evaluated. Porous cup lysimeters were used to study the effects of burning for 5 years on soil water nitrogen dynamics of tallgrass prairie. The study was performed at the Konza Prairie located 10 km south of Manhattan, Kan. Vegetation in this area is dominated by big bluestem (Andropogon gerardii Vitman), little bluestem (A. scoparius Michx.), and Indiangrass (Sorgastrum nutans (L) Nash). NO3(-)-N concentrations within the rooting zone (20 cm depth) were unaffected by burning and averaged 27 microgram/L. Concentrations at 80 cm were also similar for burned and unburned prairie and averaged 13 microgram/L. Organic N was the dominant form of N in soil water, and showed a strong effect of treatment and depth. Organic N concentrations averaged 409 microgram/L at 20 cm depth on unburned watersheds versus 295 microgram/L on burned watersheds ($P < 0.05$). Values were not influenced by burning at 80 cm depths but were 30-50% lower than those observed at 20 cm. Soil water N concentrations averaged <30% of those observed in bulk precipitation inputs, and while fire is responsible for the maintenance of the tallgrass prairie flora, fire does not appear to be an important factor affecting groundwater export of N in this biome. Total N concentrations increased from an average of circa 200 microgram/L in 1982 to an average of circa 400 microgram/L during 1986, while lysimeter volumes declined from > 400 to circa 200 mL/sample. These changes were not related to precipitation, and suggest that the soil environment sampled by the lysimeters changes through time. (Author's abstract)
W91-06966

SOLUTE DISPERSION DURING UNSTEADY LEACHING AS AFFECTED BY AGGREGATE SIZE AND SOIL WATER CONTENT.
National Inst. of Agro-Environmental Sciences, Kannondai (Japan). Div. of Soil Science.
For primary bibliographic entry see Field 2K.
W91-06968

DETERMINATION OF SOLUBLE SELENIUM IN SOILS.
Kyoto Univ. (Japan). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 5A.
W91-06970

STUDIES ON SALINE SOILS IN KHON KAEN REGION, NORTHEAST THAILAND: II. SEASONAL CHANGES OF PHYSICAL AND CHEMICAL PROPERTIES.
Khon Kaen Univ. (Thailand). Faculty of Agriculture.
For primary bibliographic entry see Field 2K.
W91-06975

STUDIES ON SALINE SOILS IN KHON KAEN REGION, NORTHEAST THAILAND: III. EFFECTS OF AMELIORATION TREATMENTS ON PHYSICAL AND CHEMICAL PROPERTIES OF THE SALINE SOIL.
Khon Kaen Univ. (Thailand). Faculty of Agriculture.
For primary bibliographic entry see Field 2K.
W91-06977

SOIL-WATER RELATIONS AND INTERFERENCE BETWEEN DEVIL'S-CLAW (PROBOSCIDEA LOUISIANICA) AND COTTON (GOSSYPIUM HIRSUTUM).
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W91-06980

EFFECT OF WATER STRESS, NITROGEN, AND GIBBERELLIC ACID ON FLUAZIFOP AND GLYPHOSATE ACTIVITY ON OATS (AVENA SATIVA).
Lincoln Coll., Canterbury (New Zealand). Dept. of Plant Science.
For primary bibliographic entry see Field 3F.
W91-06981

EFFECT OF MOISTURE ON CHLORIMURON DEGRADATION IN SOIL.
Du Pont de Nemours (E.I.) and Co., Wilmington, DE. Agricultural Products Dept.
For primary bibliographic entry see Field 5B.
W91-06988

2H. Lakes

CHARACTERIZING SURFACE WATERS THAT MAY NOT REQUIRE FILTRATION.
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
E. E. Geldreich, J. A. Goodrich, and R. M. Clark.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 40-50, December 1990. 7 fig, 11 tab, 42 ref.

Descriptors: *Disinfection, *Surface water, *Water quality standards, *Water treatment, Chlorine, Fecal coliforms, Lake stratification, Lakes, Reservoirs, Storage capacity, Thermal stratification, Turbidity, Watershed management.

A relatively clean raw surface water that is amenable to disinfection as the only controlling treatment process is with no preliminary filtration defined. The essential criteria and associated standards are: fecal coliform <20 organisms/100ml, turbidity <1.0 ntu, color <15 acu, and chlorine demand <2 mg/L. These criteria were selected from a study of data gathered form 34 raw waters used by utilities with full-scale application of disinfection as the only treatment process. Selection of water characteristics was based on the potential for impact on disinfection effectiveness and magnitude of fecal pollution tolerated. The monitoring strategy must be sensitive to frequent and unpredictable fluctuations in water quality caused by major storms and seasonal destratifications of the lake or impoundment. The utility must also meet four conditions for system operations: (1) There must be redundan-

cy in disinfection equipment to bridge emergency periods caused by equipment failure or natural disasters that disrupt power to automated chlorination; (2) Alternative source waters or finished-water storage capacity must be available for 48 h when primary source characteristics are temporarily beyond minimal quality for disinfection barrier protection; (3) Flexibility of disinfection treatment must provide options for application of different disinfectants; and (4) There must be no history of a waterborne disease outbreak within the previous 12 months and a successful action response to any previous episode. (Author's abstract)
W91-05959

DISSOLVED ORGANIC CARBON DYNAMICS IN A SMALL STREAM.
Bucknell Univ., Lewisburg, PA. Dept. of Biology.
C. J. Ciaio, and W. F. McDiffett.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 383-390, December 1990. 4 fig, 26 ref.

Descriptors: *Dissolved organic carbon, *Environmental chemistry, *Limnology, *Nutrients, *Organic carbon, *Pennsylvania, *Stream chemistry, Correlation analysis, Runoff, Seasonal variation, Stream discharge, Water chemistry, Watersheds.

Dissolved organic carbon (DOC) concentrations were monitored seasonally and during rainstorms in a small stream (watershed area ca. 60 ha) in central Pennsylvania to determine seasonal variation and patterns in the concentration of DOC of differing molecular weight, and to assess the relationship of different size fractions to stream discharge. Total DOC and DOC $<10{,}000$ MW were monitored. Considerable variation in total DOC was evident during the study period, due primarily to the $<10{,}000$ MW fraction. Values ranged from 4.92 to 13.66 mg/L. Highest concentrations occurred during the autumn and late winter, while minimum concentrations were seen during the summer months. A weak positive relationship was found between total DOC and flow rate over the course of the study, although no correlation was seen between rate of discharge and DOC $>10{,}000$ MW. During rainstorms higher concentrations of DOC were found as flow rates increased. The increased concentrations observed during rain events were due primarily to the $<10{,}000$ MW fraction, the concentrations of which were again more variable than those of the $>10{,}000$ MW fraction. This greater variability in the small molecular weight fraction was not unexpected given its more labile nature. The molecular weight distribution generally corresponded to that found in several other studies, although most of the systems investigated have shown wide variations in the total DOC concentrations. (White-Reimer-PTT)
W91-06009

SUMMER FEEDING PATTERNS OF WHITE PERCH, CHANNEL CATFISH, AND YELLOW PERCH IN THE SUSQUEHANNA RIVER, MARYLAND.
Versar, Inc., Columbia, MD.
S. B. Weisberg, and A. J. Janicki.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 391-405, December 1990. 7 fig, 3 tab, 43 ref.

Descriptors: *Diurnal variation, *Fish behavior, *Fish diets, *Stream biota, *Susquehanna River, Amphipods, Aquatic drift, Benthos, Caddisflies, Fish food organisms, Fish populations, Maryland, Midges, Population density, Species composition.

Diel feeding patterns of white perch, yellow perch, and channel catfish were investigated by the use of electroshock in the lower Susquehanna River during the summer and early fall of 1982 and 1983. On several occasions, ambient densities of benthic and drifting invertebrates were also estimated. Stomach content analysis identified that trichopterans, primarily Cheumatopsyche sp., were the dominant prey item, accounting for at least 40% of diet biomass for each fish species. The amphipod Gammarus fasciatus and chironomids accounted for more than 40% of the yellow perch and channel catfish diets, respectively, but contributed less than 10% to the diet of the other fish species. Diurnal feeding patterns were most apparent for yellow perch, whose feeding was limited almost exclusively to daylight hours. Species composition and relative abundance in the diets of all three fish were more like the composition and abundance of the benthos than of the drift, suggesting that most foraging occurred on the bottom rather than in the water column. The timing and composition of drift did not appear to be related to prey selection by any of these fish species. (Author's abstract)
W91-06010

EFFECTS OF VARYING CURRENT ON WEIGHT LOSS FROM WILLOW LEAF PACKS.
Chadwick and Associates, Littleton, CO.
S. P. Canton, and R. J. Martinson.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 413-415, December 1990. 2 tab, 14 ref.

Descriptors: *Decomposition, *Detritus, *Flow velocity, *Streamflow, *Willow trees, Channel flow, Currents, Leaf packs, Microbial degradation, Organic matter, Streams, Willow leaves.

Leaf packs of willow leaves (Salix amygdaloides) weighing 500 g each, were placed in four artificial stream channels with currents of 12,19, 26, and 31 cm/sec to determine the effects of velocity on weight loss of the packs in the absence of aquatic macroinvertebrates. In general, there was little difference in weight loss of the packs between channels. The exception to this was in the 26 and 31 cm/sec channels, which had significantly lower leaf pack weights after six weeks than the two slower channels. These differences in leaf pack weight between the 'slow' and 'fast' channels appeared to be more a factor of greater accumulation of fine particulate organic matter (FPOM) in the packs in the slower velocity channels rather than increased breakdown of packs in the faster channels. The accumulated FPOM is thought to be primarily a result of microbial colonization of the packs. FPOM accumulation was greater in the two slower channels throughout the study, with the greatest amount (46.9 mg/pack) found in the slowest channel in week 6. This contrasted to only 12.2 g/pack accumulated fines in the fastest channel during the same time period. These results suggest that current may affect the rate of breakdown of leaf packs more through control of microbial colonization or maintenance of microbial colonies, rather than physical abrasion. (Author's abstract)
W91-06011

INFLUENCE OF SEDIMENT AND GROUNDWATER ON THE DISTRIBUTION AND BIOMASS OF MYRIOPHYLLUM SPICATUM L. IN DEVIL'S LAKE, WISCONSIN.
Wisconsin Dept. of Natural Resources, Madison. Water Resources Research Section.
R. A. Lillie, and J. W. Barko.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 417-426, December 1990. 2 fig, 5 tab, 30 ref.

Descriptors: *Devils Lake, *Lake ecology, *Lake sediments, *Limnology, *Macrophytes, *Wisconsin, Aquatic plants, Biomass, Groundwater movement, Nutrients, Sediment analysis, Water milfoil, Particle size.

Influences of physical and chemical characteristics of sediments and of groundwater inputs on the distribution and biomass of Eurasion milfoil, Myriophyllum spicatum L., were studied in Devil's Lake, Wisconsin. Sediment cores from inside and outside M. spicatum beds were analyzed for density, particle size composition, moisture, organic, elemental, and nutrient contents. Groundwater direction, volume, and nutrient concentrations were determined using seepage meters. The composition of Devil's Lake littoral sediments appears inadequate to support the massive amounts of macrophytes present. The strong positive correlation between M. spicatum biomass and organic content ($p < 0.002$) suggests possible enrichment of otherwise infertile sandy sediments rather than a preference of M. spicatum for moderately organic substrates. Standing crop biomass in the lake was directly associated with nitrogen as well as potassium, since both were moderately co-associated. Groundwater inputs may have influenced the distribution of M. spicatum in the lake. While the supply of available nutrients in the sediments was relatively low, the pool of groundwater nutrients was high and may have provided an important source of nutrients for the beds. (White-Reimer-PTT)
W91-06012

FISH ASSOCIATIONS AND ENVIRONMENTAL VARIABLES IN AGE-0 COLORADO SQUAWFISH HABITATS, GREEN RIVER, UTAH.
Fish and Wildlife Service, Vernal, UT.
G. B. Haines, and H. M. Tyus.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 427-435, December 1990. 1 fig, 6 tab, 15 ref.

Descriptors: *Fish populations, *Green River, *Minnow, *Stream fisheries, Catfish, Colorado, Competition, Endangered species, Fish larvae, Habitats, Introduced species, Life cycles, Population distribution, Seasonal variation, Species composition, Streamflow, Sucker, Yampa River.

Colorado squawfish (Ptychocheilus lucius), the largest North American minnow, was once abundant and widely distributed. It now exists in less than about 20% of its historic range, and is classified as an endangered species. The species associations of age-0 Colorado squawfish were evaluated in the Green River, Utah, from their hatching through the first growing season, and the influence of several variables (i.e. backwater area, depth, and temperature; peak spring and summer discharge) on the relative abundance and distribution of the more common fishes was determined. Drifting larval fish (<30 mm total length (TL) were sampled in the Yampa River and Green River on dates corresponding to larval emergence and downstream drift of Colorado squawfish. The age-0 squawfish were sympatric with seven native and fifteen introduced fishes in the Green River. Larval squawfish was the most abundant fish captured in summer drift (38%) which included suckers, Catostomus spp. (33%), speckled dace, Rhinichthys osculus (14%), and channel catfish, Ictalurus punctatus (3%). However, ephemeral shoreline embayments used by Colorado squawfish as nursery habitats were dominated by introduced fishes, including red shiner, Notropis lutrensis (87%) in summer, and red shiner (65%) and fathead minnow, Pimephales promelas (16%) in autumn. Abundance of most fishes was highest in years of lower, more historic summer flow. Most fishes in backwaters inhabited a wide range of environmental conditions, but were most abundant in habitats deeper than 15 cm. No segregation in habitat use was detected between young Colorado squawfish and non-native fishes. Hydrologic conditions in the regulated Green River presumably favor the establishment and proliferation of fish invaders from more mesic environments. (White-Reimer-PTT)
W91-06013

SIMPLE SYSTEM OF REPLICATED RECIRCULATING EXPERIMENTAL STREAMS.
Oklahoma Univ., Kingston. Biological Station.
W. J. Matthews, F. P. Gelwick, and T. J. Gardner.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 437-443, December 1990. 2 fig, 1 tab, 12 ref. NSF Grant BSR 8706046.

Descriptors: *Artificial streams, *Hydraulic models, *Laboratory methods, *Streams, Algae, Artificial substrates, Costs, Crayfish, Experimental streams, Hydraulic systems, Minnow, Pumps, Simulation models, Snails.

A system of recirculating artificial streams was developed that has low initial cost and operating expense and operates efficiently over long periods of time. Although individual stream units are large enough to accommodate minnows and crayfish, they are sufficiently compact that replication with up to 12 streams is possible in a relatively small laboratory. The system is simple in design, with no moving parts (except pumps) and no costly flow meters or regulating devices. Replication of stream

units is facilitated by depending on inlet ports of fixed size, full-capacity operation of pumps, and uniform diameters of distribution systems. Each individual stream unit consists of a circular tank in which a submersible pump moves water unidirectionally around a center post. Tanks are sturdy molded black polypropylene plastic with a top diameter of 140 cm and a depth of 53 cm. The center post is a 20 liter plastic bucket weighted in place by filling it with water and stones. Water is circulated by a 1/15 horsepower submersible centrifugal pump. Up to 12 units can be combined together for water-exchange and inflow-outflow of water in different applications. The system has been operated for almost a year with very little cost or repair. Substrates incubated in the laboratory streams readily grow an algal flora similar to that of nearby natural streams, and fish, crayfish and snails exhibit normal activities in the streams. Total cost for construction of a 12-stream system was less than $3,500. (White-Reimer-PTT)
W91-06014

DETERMINISTIC MODEL OF THE RESPONSE OF THREADFIN SHAD TO AQUATIC MACROPHYTE CONTROL.
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 4A.
W91-06015

MACROINVERTEBRATE COMMUNITIES ASSOCIATED WITH THREE AQUATIC MACROPHYTES (CERTOPHYLLUM DEMERSUM, MYRIOPHYLLUM SPICATUM, AND VALLISNERIA AMERICANA) IN LAKE ONALASKA, WISCONSIN.
National Fisheries Research Center, La Crosse, WI.
E. W. Chilton.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 455-466, December 1990. 5 fig, 1 tab, 20 ref.

Descriptors: *Lake Onalaska, *Limnology, *Macroinvertebrates, *Macrophytes, *Species composition, *Stream biota, Amphipods, Aquatic insects, Ceratophyllum, Habitats, Mississippi River, Odonata, Population density, Taxonomy, Vallisneria, Water milfoil, Wisconsin.

In large river systems, backwater areas often serve as a nursery habitat for a variety of fish. Invertebrates constitute a vital food source for many of these fish, in both juvenile and adult stages. The standing crop and species diversity of macroinvertebrates associated with wild celery (Vallisneria americana), Eurasion watermilfoil (Myriophyllum spicatum), and coontail (Ceratophyllum demersum) were examined in Lake Onalaska, Pool 7 of the upper Mississippi River, during the summer 1983. A total of 140 macrophyte-associated invertebrate taxa were identified. The most abundant taxonomic groups were Amphipoda, Diptera, Gastropoda, Hemiptera, Odonata, and Tricoptera. These groups comprised more than 90% of the specimens collected. Other groups that were sometimes numerically important were Ephemeroptera, Lepidoptera, and Oligochaeta. Although Ceratophyllum generally supported the largest invertebrate standing crop (number per g plant dry weight), differences in invertebrate abundance among plant species were not consistent across time. However, the distribution of several taxa were significantly affected by plant species. Hyalella azteca (overall the most abundant species) and Enallagma spp. (the most abundant predator) were consistently the most numerous in Ceratophyllum samples and least abundant in Vallisneria samples. Generally, invertebrate community composition differed significantly among plant species throughout the year. (White-Reimer-PTT)
W91-06016

IMPORTANCE OF EMERGENT VEGETATION IN REDUCING SEDIMENT RESUSPENSION IN WETLANDS.
South Dakota State Univ., Brookings. Dept. of Wildlife and Fisheries.
C. D. Dieter.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 467-473, December 1990. 3 fig, 2 tab, 14 ref.

Descriptors: *Aquatic vegetation, *Limnology, *Sediment transport, *Suspended sediments, *Wetlands, *Wind-driven currents, Habitats, Lake sediments, Macrophytes, Marshes, Mud Lake, Sand Lake, Sand Lake National Wildlife Refuge, Sediment resuspension, Sediment sampler, South Dakota.

Wind-induced resuspension of bottom sediment was measured with sediment traps in Sand Lake National Wildlife Refuge, South Dakota. The primary objective was to compare the amount of resuspension of the marsh substrate caused by wind-induced wave action in: (1) open areas unprotected from wind by emergent vegetation; (2) areas moderately protected by emergent vegetation; and (3) areas completely protected by emergent vegetation. Three sampling stations were selected in both Mud Lake and Sand Lake pools, and in an intermediate area. There was a significant difference in the amount of sediment resuspended in the three habitat types when data from both marshes were combined. Sediment resuspension was significantly greater in open areas (5 g/trap) than in moderately protected area (2.7 g/trap) or in greatly protected areas (1.6 g/trap). There were no significant differences among the average wind speeds, which ranged from 9 to 11 mph, during the four sampling periods. The results illustrate that wind-induced resuspension of bottom sediment is negated by dense stands of emergent vegetation. Turbidity was higher in open water areas than in moderately or greatly protected areas in both pools. Resuspended sediment was apparently uniformly distributed throughout the water column. (White-Reimer-PTT)
W91-06017

DIFFERENTIAL COLONIZATION AND GROWTH OF ALGAE AND FERROMANGANESE-DEPOSITING BACTERIA IN A MOUNTAIN STREAM.
Middlebury Coll., VT. Dept. of Biology.
S. P. Sheldon, and D. K. Skelly.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 475-485, December 1990. 3 fig, 3 tab, 15 ref.

Descriptors: *Aquatic bacteria, *Diatoms, *Mountain streams, *Periphyton, *Vermont, Algae, Colonization, Iron, Leptothrix, Limiting factors, Limnology, Manganese, Species composition.

The structure of the epilithic communities of lotic systems is a function of both abiotic and biotic factors. A small mountain stream in northern Vermont where the epilithic community undergoes a radical shift in dominance from diatoms to the ferromanganese-depositing bacterium, Leptothrix ochracea, within a distance of less than ten meters, was examined. Eight sample locations were chosen along the study section of the brook, and algal and bacterial colonization were quantified using both unglazed tiles and glass microscope slides at each of the sites. Over a 1 km stretch of the brook the species-rich diatom community was replaced by a nearly mono-specific community of Leptothrix, and is subsequently replaced by a diverse diatom assemblage. Concurrent with this shift, iron concentration increased 24 fold and manganese increased 20 fold. Disturbances (digging and placement of a lined septic system in the vicinity) most likely resulted in the mobilization of these ions in the stream. Over the subsequent course of the stream, concentrations of iron and manganese decreased. There are a number of algae-bacteria interactions which could account for the observed pattern of algal and Leptothrix distribution. The bacteria could limit the availability of nutrients for algae, competition for space could be limited by the bacteria, and/or the bacteria could be heterotrophs that attack algal cells directly. (White-Reimer-PTT)
W91-06018

CURRENT DISTRIBUTION AND STATUS OF THE UPPER CUMBERLAND RIVER JOHNNY DARTER, ETHEOSTOMA NIGRUM SUSANAE.
Tennessee Cooperative Fishery Research Unit, Cookeville.
C. J. O'Bara.
Journal of the Tennessee Academy of Science JTASAG, Vol. 66, No. 1, p 9-11, January 1991. 1 fig, 1 tab, 8 ref.

Descriptors: *Cumberland River, *Darters, *Fish populations, Distribution patterns, Endangered species, Flow profiles, Habitats, Kentucky, Population dynamics, Sediments, Silt load, Tennessee, Water pollution effects.

Seventy locations within 38 lotic systems, in the upper Cumberland River system of Kentucky and Tennessee, were sampled to determine the current status of the upper Cumberland River johnny darter, Etheostoma nigrum susanae. Fifteen locations were found to contain the subspecies of which six were new distributional records. The 15 locations represent eight distinct populations isolated by either poor quality reaches, impoundments, or natural barriers. Habitat consisted of shallow, low velocity reaches with a sand or sand gravel substrate. The major limiting factor to the subspecies' continued existence is siltation attributed to coal mining and related activities. The restricted distribution and isolation of E. nigrum susanae populations warrant concern for the subspecies' future. (Author's abstract)
W91-06019

SEASONAL VARIATIONS IN BACTERIAL COMMUNITIES IN ADIRONDACK STREAMS EXHIBITING PH GRADIENTS.
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Biology.
M. P. Osgood, and C. W. Boylen.
Microbial Ecology MCBEBU, Vol. 20, No. 3, p 211-230, 1990. 7 fig, 2 tab, 43 ref.

Descriptors: *Acid rain effects, *Adirondack Mountains, *Aquatic bacteria, *Hydrogen ion concentration, *Mountain streams, Biomass, New York, Nutrients, Organic matter, Plankton, Productivity, Seasonal variation, Water chemistry.

Small woodland stream ecosystems are largely dependent on externally produced organic matter. These flowing-water environments can provide a continuous, albeit uneven, supply of nutrients to stream organisms. Nutrients do not cycle in place but are displaced downstream in what has been described as a spiral, through sediments, organisms, and water. Spiraling can be influenced significantly by physical, chemical, and biological factors. The bacterial numbers, total viable microbial biomass, and bacterial production spatially as well as temporally were followed in three low-order Adirondack streams in New York State for two years. The primary focus was on seasonal patterns of acid-impacted bacterial communities and the effect on these populations of water chemistry parameters, especially those related to pH. These streams exhibited spatial and temporal gradients in water pH ranging from a high of 7.0 to a low of 4.5. Twelve sites along these streams were used for comparative analysis of the effects of pH and water chemistry on the planktonic, sedimentary, and epilithic bacterial communities. The planktonic bacterial communities were not influenced by water pH or related water chemistry parameters. For sedimentary populations, the organic content of the sediment was more important than the chemistry of the overlying water. The epilithic bacterial communities, however, were influenced significantly by the pH of the water column, showing decreased bacterial production at lower pH. (White-Reimer-PTT)
W91-06022

EXPLANATION FOR THE DECLINE OF BACTERIA INTRODUCED INTO LAKE WATER.
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
For primary bibliographic entry see Field 5B.
W91-06023

QUALITATIVE IMPORTANCE OF THE MICROBIAL LOOP AND PLANKTON COMMUNITY STRUCTURE IN A EUTROPHIC LAKE DURING A BLOOM OF CYANOBACTERIA.
Vandkvalitetsinstitutet, Hoersholm (Denmark).
K. Christoffersen, B. Riemann, L. R. Hansen, A. Klysner, and H. B. Sorensen.
Microbial Ecology MCBEBU, Vol. 20, No. 3, p 253-272, 1990. 8 fig, 4 tab, 71 ref.

Descriptors: *Algal blooms, *Cyanophyta, *Eutrophic lakes, *Lake ecology, *Limnology, *Plankton, Algae, Bacteria, Biomass, Denmark, Ecosystems, Food chains, Organic carbon, Phytoplankton, Species composition, Zooplankton.

Plankton community structure and major pools and fluxes of carbon were observed before and after the culmination of a bloom of cyanobacteria in eutrophic Frederiksborg Slotsso, Denmark. Biomass changes of heterotrophic nanoflagellates, ciliates, microzooplankton (50 to 140 microm) and macrozooplankton (larger than 140 microm) were compared to phytoplankton and bacterial production as well as micro and macrozooplankton ingestion rates of phytoplankton and bacteria. Phytoplankton biomass decreased and algae smaller than 20 microm replaced Aphanizomenon after the culmination of cyanobacteria. Bacterial net production peaked shortly after the culmination of the bloom and decreased thereafter to a level of approximately 124 microg C/L. Cyclopoid copepods and small-sized cladocerans started to grow after the culmination, but food limitation probably controlled the biomass after the collapse of the bloom. Grazing of microzooplankton and macroplankton were estimated from in situ experiments using labeled bacteria and algae. Macrozooplankton grazed 22% of bacterial net production during the bloom and 86% after the bloom, while microzooplankton (nauplii, rotifers and ciliates larger than 50 microm) ingested low amounts of bacteria and removed 10-16% of bacterial carbon. Both macrozooplankton and microzooplankton grazed algae smaller than 20 microm, although they did not control algal biomass. From calculated clearance rates it was found that heterotrophic nanoflagellates grazed 3-4% of the bacterial production, while ciliates smaller than 50 microm removed 19-39% of bacterial production, supporting the idea that ciliates are an important link between bacteria and higher trophic levels. During and after the bloom of Aphanizomenon, major fluxes of carbon between bacteria, ciliates and crustaceans were observed, and heterotrophic nanoflagellates played a minor role in the pelagic food web. (Author's abstract)
W91-06024

BLOOM OF A BROWN PHOTOTROPHIC SULFUR BACTERIUM IN LAKE KINNERET: HYDROCHEMICAL ASPECTS.
Kinneret Limnological Lab., Tiberias (Israel).
W. Eckert, Y. Z. Yacobi, and H. G. Truper.
Microbial Ecology MCBEBU Vol. 20, No. 3, p 273-282, 1990. 5 fig, 1 tab, 37 ref.

Descriptors: *Hydrogen sulfide, *Lake Kinneret, *Light intensity, *Limnology, *Sulfur, *Water chemistry, Africa, Aquatic bacteria, Biomass, Chemical properties, Dissolved oxygen, Hydrogen ion concentration, Sulfur bacteria, Temperature, Thermocline.

High concentrations of phototrophic sulfur bacteria are commonly observed in the metalimnion of stratified water systems. The main ecological factors triggering these bacterial blooms are known to be hydrogen sulfide and light intensity. In Lake Kinneret, Africa, an annual bloom of the brown phototrophic sulfur bacterium Chlorobium phaeobacteroides appears from July until September, when the thermocline is stabilized at a depth between 14 and 18 m. The direct influence of phototrophic bacteria on the prevailing hydrochemical conditions was studied. Temperature, dissolved oxygen, pH, and pH2S values were measured, and cell numbers of phototrophic sulfur bacteria were determined. The water column profiles gave no direct evidence of the phototrophic bacterial impact on metalimnic conditions. There were significant correlations between the Chlorobium biomass and the prevailing redox conditions (positive) and the total sulfide concentration (negative). Under the prevailing hydrochemical conditions in the metalimnion of Lake Kinneret, the measured in situ electroactivities are probably dominated by the ambient sulfide concentrations, which are also subjected to phototrophic bacterial oxidation. Therefore the measured metalimnetic redox changes can be explained by the consumption of reducing power through Chlorobium phaeobacteroides, that is, an indirect redox effect caused by sulfide uptake. (White-Reimer-PTT)
W91-06025

EFFECTS OF RESERVOIR ENLARGEMENT AND OTHER FACTORS ON THE YIELD OF WILD RAINBOW AND CUTTHROAT TROUT IN SPADA LAKE, WASHINGTON.
Washington Cooperative Fishery Research Unit, Seattle.
T. B. Stables, G. L. Thomas, S. L. Thiesfeld, G. B. Pauley, and M. A. Wert.
North American Journal of Fisheries Management NAJMDP, Vol. 10, No. 3, p 305-314, Summer 1990. 2 fig, 6 tab, 27 ref.

Descriptors: *Fish populations, *Reservoir fisheries, *Spada Lake, *Trout, Creel, Fisheries, Productivity, Reservoir capacity, Sport fishing, Washington, Water quality.

Spada Lake in Snohomish County, Washington, is a reservoir that supports wild populations of rainbow trout Oncorhynchus mykiss, cutthroat trout Oncorhynchus clarki, and hybrids of these species, which sustain a locally popular sport fishery. Creel surveys were conducted in 6 years between 1979-1988 to assess the effect on the fishery of enlargement of the reservoir in 1984. The available creel survey and water quality data were synthesized to evaluate the effect of enlargement and other factors on the yield of wild trout. Yield increased from less than 1,000 kg/y before enlargement to nearly 5,000 kg/y immediately after enlargement and then declined. Harvest per unit of effort was variable, but mean length of trout in the harvest declined steadily after enlargement until a minimum-length limit was imposed in 1988. Analysis of year-class abundance indicated that natural production in stream spawning and rearing areas after lake enlargement remained sufficient to sustain the fishery, but that harvests exceeded the sustainable level of lacustrine production. Estimation of lake production capacity from the morphoedaphic index (total dissolved solids/mean lake depth) indicated that, although total potential yield (kg/y) may have increased 84% after enlargement, sustainable yield was exceeded in both periods until harvest was reduced by the change in fishing regulations. Only moderate trout growth rates, compared with those in other lakes, and a diet consisting primarily of small invertebrates pointed to a limited production potential for Spada Lake. The yield of rainbow trout was further limited, relative to that of cutthroat trout, by higher natural mortality of fish older than age 2. (Author's abstract)
W91-06029

RECOVERY OF LAKES IN THE 1980 BLAST ZONE OF MOUNT ST. HELENS.
Washington Univ., Seattle. Fisheries Research Inst.
R. C. Wissmar.
Northwest Science NOSCAX, Vol. 64, No. 5, p 268-270, November 1990. 5 fig, 10 ref.

Descriptors: *Limnology, *Mount St Helens, *Mountain lakes, *Succession, *Volcanoes, *Washington, Alkalinity, Castle Lake, Chemical properties, Coldwater Lake, Ecological effects, Ecosystems, Geochemistry, Hydrogen ion concentration, Plankton, Spirit Lake, Turbidity.

Over the past 10 years, following the catastrophic 1980 eruption of Mount St. Helens, considerable research has been conducted on altered and newly created lake ecosystems in different depositional regions of the blast zone. Impact and recovery characteristics have been followed for the altered Spirit Lake and two newly created lakes S. F. Castle and Coldwater Lakes. During the 1980 eruption, Spirit Lake was directly impacted by debris avalanches and pyroclastic flows. The unique characteristics of the Mount St. Helens volcanic eruption and geochemistry, such as low inputs of sulfate and high loadings of organics from devastated forests to lakes, combined to form chemical environments favorable to biological activity. Even though weathering, organic and microbial reactions were evidently the important processes regulating alkalinity of these lakes, patterns of changes in pH, total alkalinity, and dissolved organic carbon and changes in microbial assemblages and processes also suggested a sequence of biological reactions that occurred during the early recovery period of 1980 and 1981. The biological recovery of the lakes via succession of microbial reactions suggests a tendency for the higher energy producing reactions to dominate lesser energy producing reactions. As turbid and high suspended particulate matter levels decreased, phytoplankton primary production increased to produce mixed bacteria-phytoplankton-zooplankton communities. (White-Reimer-PTT)
W91-06033

ROLE OF REFUGIA IN THE RECOLONIZATION OF STREAMS DEVASTATED BY THE 1980 ERUPTION OF MOUNT ST. HELENS.
Utah State Univ., Logan. Dept. of Fisheries and Wildlife.
C. P. Hawkins, and J. R. Sedell.
Northwest Science NOSCAX, Vol. 64, No. 5, p 271-274, November 1990. 1 tab, 5 ref. NSF contracts BSR-841627, BSR-8414325, and BSR-8508356.

Descriptors: *Colonization, *Detritus, *Ecosystems, *Mt St Helens, *Refugia, *Stream biota, *Volcanoes, *Washington, Algae, Amphibians, Clearwater Creek, Dispersal, Ecological effects, Fish, Invertebrates.

The 1980 eruption of Mount St. Helens eliminated stream communities in several surrounding basins. The eruption had two primary effects on the physical environment of these streams. First, massive quantities of ash and volcanic debris entered many stream channels. Second, the upslope forest and riparian communities were destroyed or dramatically altered. Since the eruptions, the character of these streams has started to return to pre-eruption conditions. The recovery of the stream biota in the Clearwater Creek basin located just inside the blast zone has been studied for the last 10 years. It was found that the different types and intensities of disturbance within the Clearwater basin produced systems with different amounts and types of refugia (individual patches embedded within complex environments that protect organisms from disturbances). Differences in refugia among streams strongly influenced recolonization by different kinds of stream biota. For algae the specific location of refugia and their proximity to disturbed reaches within a basin were probably not significant with respect to patterns and rates of recovery. Composition of the invertebrate communities in the streams appeared to be largely a function of differences in temperature and random colonization. For amphibians, recolonization may take 100 yr or more because of the combination of distance to nearest refuge and slow dispersal rates. Recovery of fish populations in this stream was completely dependent on the existence of refugia within the basin, because a 30 m waterfall blocked any migration from downstream. The trajectories of overall community recovery in the disturbed streams near Mount St. Helens depends on several factors: (1) the type of habitats surviving; (2) the mix of species within those habitats that can act as colonists; (3) the dispersal abilities of individual species; and (4) the degree to which and the length of time it takes different stream environments to return to stable conditions. (White-Reimer-PTT)
W91-06034

SUCCESSION OF PHYTOPLANKTON IN LAKE SOYANG.
Kangweon National Univ., Chuncheon (Republic of Korea). Dept. of Biology.
K. S. Cho, B. C. Kim, and W. M. Heo.

Physiology and Ecology Japan PEJAE6, Vol. 27, p 81-92, March 1990. 7 fig, 16 ref, append.

Descriptors: *Algal blooms, *Korea, *Lake Soyang, *Lake ecology, *Limnology, *Nitrogen, *Phytoplankton, Anabaena, Cyanophyta, Diatoms, Dinoflagellates, Ecosystems, Euphotic zone, Peridinium, Seasonal variation, Stratification, Succession.

The phytoplankton community of Lake Soyang in Korea has received attention because of the local bloom of the dinoflagellate, Peridinium bipes, which occurs yearly in warm seasons. Recently bluegreen algae blooms have also appeared in the summer under conditions of high nitrogen concentrations. The seasonal succession of dominant species in the lake is distinct. In winter and spring diatoms (Asterionella formosa and A. gracillima) were dominant, while Peridinium bipes and bluegreen algae were dominant in the warm seasons. Since 1986, Peridinium has been replaced with Anabaena. Thus the seasonal succession sequence of Asterionella-Peridinium-Asterionella has changed to Asterionella-Peridinium-Anabaena-Asterionella. Bluegreen algal blooms are well-known indicators of lake eutrophication. However, a remarkable finding in this study is that bluegreen blooms are occurring in a nitrogen-rich environment where the N/P ratio is very high, and it is rare for bluegreen algae blooms to occur in waters with a high N/P ratio. The reason for bluegreen algae to flourish is not known, but the buoyancy of Anabaena which allows it to reside in the euphotic zone may be a possible mechanism. In spring, the depth of the surface mixing layer is shallow and phytoplankters with high sinking velocity can survive. However, in late summer, intermediate currents of inflowing water make a thick mixing layer and buoyant phytoplankters have an advantage in competing for light. (White-Reimer-PTT)
W91-06035

TEMPERATURE PREFERENCE VERSUS ACCLIMATION IN FISHES: SELECTION FOR CHANGING METABOLIC OPTIMA.
Eastern New Mexico Univ., Portales. Dept. of Life Sciences.
S. W. Kelsch, and W. H. Neill.
Transactions of the American Fisheries Society TAFSAI, Vol. 119, No. 4, p 601-610, July 1990. 7 fig, 2 tab, 32 ref.

Descriptors: *Fish behavior, *Fish physiology, *Model studies, *Temperature effects, Acclimation, Bluegills, Carp, Metabolism, Water temperature.

A model was developed that accounts for the variety in observed relationships between temperature preference and acclimation in fish. The model's premise is that fish prefer temperatures that are an integrated optimum for metabolic processes; that is, fish prefer temperatures that afford the maximum potential to do work on their environment. Given that temperatures selected by fish are a function of acclimation temperature, then--if the model is correct--the temperature corresponding to the maximum scope must also change with acclimation. An experiment was conducted that involved a series of tests to determine the critical swimming speeds of naive blue tilapias and bluegills at three test temperatures for each of three acclimation temperatures. The data were considered to support the model if the animals were able to swim faster at their preferred temperature than at test temperatures immediately above and below the preferred temperature. The results supported the model. The primary value of the model is that it demonstrates the commonality of numerous disjunct concepts and makes corresponding predictions. These concepts of thermal optimum, maximum scope for metabolism, activity metabolism, and temperature preference all appear to be interrelated. For any acclimation temperature, the model predicts correspondence between the preferred temperature, the temperature for maximum scope, and the temperature for maximum critical swimming speed. Thus, behavioral tendency (temperature preference) can be predicted on the basis of physiological capacity (metabolic scope), which presumably is less subject to inherent variability. (White-Reimer-PTT)
W91-06036

YIELD OF YELLOW PERCH IN LAKES ERIE AND ST. CLAIR: COMMUNITY ASSOCIATIONS.
Ontario Ministry of Natural Resources, Maple. Fisheries Branch.
B. A. Henderson, and S. J. Nepszy.
Transactions of the American Fisheries Society TAFSAI, Vol. 119, No. 4, p 741-756, July 1990. 10 fig, 5 tab, 43 ref.

Descriptors: *Commercial fishing, *Fish populations, *Great Lakes, *Lake Erie, *Limnology, *Perch, Biomass, Correlation analysis, Regression analysis, Species composition, Temperature, Water temperature.

Commercial catches of yellow perch Perca flavescens in the Canadian gill-net fishery of Lake Erie declined in the 1970s, even though fishing efforts increased and mesh size decreased between 1970 and 1975. Multiple stepwise regression of annual catch (kg) on effort (km gill net), recruitment by year-class, total fish community biomass, and weight at age 3 showed that only recruitment explained a significant portion of the variations in catches in the eastern basin, and only weight was important in the western basin. Year-class strength declined in the late 1960s and 1970s; catches from both experimental and commercial gear provided some indication of improvement by the 1980s. Although recruitment was associated with variations in the abundance of some species in four fish communities (Lake St. Clair and the three basins of Lake Erie), there was no evidence that any common groups of species were regulating recruitment. Fish community structures were similar (discriminant function analysis) in the eastern and central basins; the western basin and St. Clair communities were different, but more similar to each other than to the other two basins. Temporal changes in community structure within basins were not associated with water temperature variables (canonical correlation). Temporal correlations of abundance were correlated with spatial correlations of abundance, indicating that negative interspecific interactions were greater for species with less overlap in habitat. It was concluded that there was no evidence that interspecific interactions regulated community structure or yellow perch recruitment. (Author's abstract)
W91-06037

EVOLVING ISSUES ON DEVELOPMENT AND CONSERVATION OF LAKE BIWA--YODO RIVER BASIN.
Kyoto Univ., Otsu (Japan). Otsu Hydrobiological Station.
For primary bibliographic entry see Field 6D.
W91-06049

EFFECT OF WATER PURIFICATION ECOLOGICAL ENGINEERING ON THE CAO YANG ROUND CREEK.
Jiaotong Univ., Shanghai (China). Dept. of Applied Chemistry.
For primary bibliographic entry see Field 5G.
W91-06052

STUDY OF THE EUTROPHICATION OF NORTH LAKE, WESTERN AUSTRALIA.
Murdoch Univ. (Western Australia). School of Biological and Environmental Sciences.
For primary bibliographic entry see Field 5C.
W91-06056

ECOLOGICAL STUDIES ON THE HYDROMEDUSAE, SIPHONOPHORES AND CTENOPHORES IN THE XIAMEN HARBOR AND ADJACENT WATERS.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
For primary bibliographic entry see Field 2L.
W91-06106

POPULATION DYNAMICS AND SECONDARY PRODUCTION OF OWENIA FUSIFORMIS DELLE CHIAJE (POLYCHAETA) FROM THE BAY OF SEINE (EASTERN ENGLISH CHANNEL).
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
F. Menard, F. Gentil, and J. C. Dauvin.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 133, No. 1/2, p 151-167, December 14, 1989. 4 fig, 6 tab, 32 ref. Centre National pour l-Exploitation des Oceans contracts 81-6534 and 82-6915.

Descriptors: *Bays, *Benthic fauna, *English Channel, *Polychaetes, *Population dynamics, *Productivity, Aquatic life, Aquatic productivity, Growth, Life cycles, Mortality, Population density.

Owenia fusiformis Delle Chiaje is the only species in the genus Owenia. It has been reported from areas world-wide; from the low-water mark to depths of at least 1700 m, possibly to 4554 m. However, geographical and bathymetric distribution of O. fusiformis is uncertain as it is questioned whether any of the cosmopolitan polychaete species are a single species. The life cycle, population dynamics and production of Owenia fusiformis Delle Chiaje from the muddy fine sand community in the Bay of Seine were studied at two stations from May 1981 to September 1983. Densities showed large and synchronized variations at both stations; means were 1110 and 327 individuals/sq m. Recruitment occurred at the end of the spring or during the summer. The number of recruits varied strongly from one year to another. Recruitments were marked in 1983 and weak in 1981-1982. Growth of young individuals was rapid during the summer and the beginning of the autumn, then slowed down in October and stopped during autumn and winter. Growth resumed in April for the overwintered specimens and continued during the spring and the summer. Growth rates were similar from one year to another for all the year classes. The mortality rate was higher for the 4th year of life than it was for the first 3 years of life. The maximum life span was 4 years at both stations but the mean life span did not exceed 3 years at Station A and 2-3 years at Station B. Production was estimated for two annual cycles at both stations. Growth production varied from 4.2 to 18.8 g dry weight/square m/year and elimination production from 1.7 to 33.6 g dry weight/square m/year. Growth production/average biomass ratios ranged from 0.75 to 1.55 and elimination production/average biomass ratios from 0.6 to 1.85. Production, and growth production/biomass ratios, were similar to previously published data for other populations of Polychaetes which live >/= 3 years. (Mertz-PTT)
W91-06246

FUNGAL CONTROL OF POPULATION CHANGES OF THE PLANKTONIC DIATOM ASTERIONELLA FORMOSA IN A SHALLOW EUTROPHIC LAKE.
Tokyo Univ. (Japan). Dept. of Botany.
S. Kudoh, and M. Takahashi.
Journal of Phycology JPYLAJ, Vol. 26, No. 2, p 239-244, 1990. 4 fig, 2 tab, 33 ref. Ministry of Education, Science and Culture, Japan Project Research No. 60129034.

Descriptors: *Asterionella, *Diatoms, *Eutrophic lakes, *Limnology, *Parasitism, *Pathogenic fungi, Biological interactions, Biological studies, Japan, Lakes, Mortality, Population density, Temperature effects.

Many freshwater and some marine algal species are infected by parasitic organisms such as fungi, phage, virus or bacteria and are killed by loss of cellular contents. These types of biological interactions also affect the population size of the host algae. Studies have shown that the diatom Asterionella formosa and its fungal parasite have a host-parasite interaction that is species-specific and that the parasite grows only on live algal cells by consuming host protoplasm. Low infection percentages of an A. formosa population by fungi in winter in a reservoir (Lake Suwa, Japan) are probably due to extremely low temperatures. Field

studies were conducted at 2 to 14-day intervals from November 1986 to November 1987 on the shallow, eutrophic Lake Suwa, located in a fault basin in central Japan. Parasitic fungi infected an A. formosa Hass. population for 10 months of the year, during which time the population density of the alga was over 100 cells/L. High infection rates of more than 20% of the cells were observed between February and July, except on a few occasions such as late April and late June. Mortality of infected diatom cells was temperature dependent in dialysis tube culture experiments; the loss rate of field populations due to fungal infection also was affected by temperature. Loss rates of diatom cells were negligibly small in February even though infection percentages were more than 20%, but increased toward summer with an increase in temperature. High infection percentages and correspondingly high loss rates occurred periodically during the summer. The results suggest that this type of host-parasite interaction is an important control of algal population size in natural waters. (Mertz-PTT)
W91-06247

INFLUENCE OF VARIOUS EXPOSURE PERIODS ON THE BIOMASS AND CHLOROPHYLL A OF CLADOPHORA GLOMERATA (CHLOROPHYTA).
Northern Arizona Univ., Flagstaff. Dept. of Biology.
H. D. Usher, and D. W. Blinn.
Journal of Phycology JPYLAJ, Vol. 26, No. 2, p 244-249, 1990. 4 fig, 1 tab, 42 ref.

Descriptors: *Algae, *Algal growth, *Chlorophyta, *Cladophora, *Dam effects, *Ecological effects, *Limnology, *Reservoirs, *Tailwater, Biomass, Chlorophyll a, Reservoir releases, Rivers, Stranding, Ultraviolet light.

Several studies have addressed the changes in tailwater algal communities that result from modified physico-chemical features below reservoirs. However, the impacts of stranding on algal populations in regulated rivers has received little attention. The biomass of Cladophora glomerata (L.) Kutz. was estimated at selected sites in the Colorado River between Glen Canyon Dam, Arizona, and River Kilometer 345. C. glomerata biomass was significantly higher at sites above Lees Ferry (25 km downstream from the Dam) than sites below the Ferry. Biomass and chlorophyll a were significantly reduced when C. glomerata was subjected to one-time exposures to the atmosphere for 12 daylight hours or more. Repeated 12/12 hour and 24/24 hours (exposure/submergence) cycles over a two-week period also showed a significant reduction in biomass. This infers that ultraviolet light during the day is harmful and desiccation rates during darkness are slower, perhaps due to higher relative humidities and lower temperatures during the night. Exposed filaments near the holdfast that are not protected by a neighboring plant are the first parts of the C. glomerata tuft to be exposed to the atmosphere and the first portion of the tuft to dry. These filaments are therefore most susceptible to desiccation and damage due to exposure. As the river begins to rise, weakened filaments are easily broken, resulting not only in the loss of the damaged portions of filaments, but in the loss of the viable terminal tufts as well. After repeated cycles of exposure over long periods of time, the long tufts in the shallower portions of the river bed may be nearly eradicated and thereby expose the basal holdfast. Continued exposure of the river bed may damage the holdfast and inhibit regeneration of C. glomerata in the exposed zones. (Mertz-PTT)
W91-06248

EFFECTS OF LIGHT AND WAVE DISTURBANCE ON VERTICAL ZONATION OF ATTACHED MICROALGAE IN A LARGE RESERVOIR.
Texas Christian Univ., Fort Worth. Dept. of Biology.
K. D. Hoagland, and C. G. Peterson.
Journal of Phycology JPYLAJ, Vol. 26, No. 3, p 450-457, 1990. 4 fig, 3 tab, 16 ref.

Descriptors: *Algae, *Algal growth, *Diatoms, *Light effects, *Limnology, *Reservoirs, *Wind waves, Growth, Light intensity, Population dynamics, Species diversity, Water depth, Waves.

Experimental field manipulations of artificial substrata were used to examine the mechanism controlling attached algal zonation down the face of the dam in Lake McConaughy, a large reservoir in western Nebraska. Sets of clay tiles were incubated in the upper (2.5 m depth) and lower (8 m depth) growth zones for two weeks. Five sets of tiles were then switched from the upper to the lower growth zone and vice versa. Five additional sets of tiles were switched to the lower zone and artificially disturbed. Diatom cell densities increased rapidly in both zones; however, wind-induced turbulence caused dramatic declines (up to 61%) in densities in the upper zone. Consequently, cell densities in the upper and lower growth zones were not significantly different after four weeks, despite the 17-30% higher light levels in the upper zone. Based on cell densities and relative abundances on clay tiles and naturally occurring rocks, 26 of the 32 most common diatom taxa had a significant upper (10) or lower (16) zone preference. Of these, 15 taxa exhibited a consistent response to one or both switching manipulations, confirming a growth zone preference, and two showed a clear preference for disturbed substrata. Diatom growth form appeared to play a major role in determining the vertical zonation of attached communities, since actively motile taxa exhibited a lower zone preference and stalked forms occurred primarily in the upper zone. This study indicates that light attenuation and wave disturbance are primary mechanisms that control the vertical zonation of freshwater epilithic algae. (Author's abstract)
W91-06250

DISTRIBUTION AND ALGAL-LYSING ACTIVITY OF FRUITING MYXOBACTERIA IN LAKE SUWA.
Meiji Univ., Kawasaki (Japan). Faculty of Agriculture.
Y. Yamamoto, and K. Suzuki.
Journal of Phycology JPYLAJ, Vol. 26, No. 3, p 457-462, 1990. 5 fig,, 4 tab, 20 ref. The Ministry of Education, Science and Culture, Japan Special Project Research No. 60129034.

Descriptors: *Algal blooms, *Cyanophyta, *Eutrophic lakes, *Japan, *Limnology, *Myxobacteria, Bacteria, Ecology, Lake Suwa, Lake sediments, Oxygen, Seasonal variation, Wave action.

The fruiting myxobacteria are gliding bacteria with the unique property of being decomposers of other bacteria and plant debris. Although the taxonomy and physiology of these bacteria have been extensively studied, knowledge of their ecology is scant. They are commonly isolated from soil, but only a few studies have demonstrated their occurrence in aquatic habitats. The seasonal distribution of fruiting myxobacteria, which are able to lyse cyanobacteria in the water and sediments of eutrophic lakes, was determined periodically in 1985 and 1986. Fruiting myxobacteria isolated from sediments of these sites were found to have a lytic effect on a wide variety of cyanobacteria. The myxobacterium isolate designated as S-1-8 was identified as Myxococcus fulvus Cohn. Lytic activity for cyanobacteria was produced during growth of the organism in a number of complex media. The maximal amount of activity was produced in casitone-yeast media and at the end of the log phase of growth. Usually, fruiting myxobacteria are thought to be highly aerobic and unable to grow under anaerobic conditions. Lake Suwa is a shallow hypertrophic lake that supports blooms of cyanobacteria every summer. During the summer the oxygen produced by photosynthetic plants reaches 200% of saturation at the lake surface but often decreases markedly at the sediment surface. Such low levels of oxygen are unsuitable environments for the growth of fruiting myxobacteria. In this shallow lake, the water is easily mixed by wave action caused by winds, and the oxygen-depleted condition does not appear to occur for long periods. Therefore, when large amounts of organic substrate containing living or dead cyanobacteria are supplied, myxobacteria multiply easily and in turn lyse them. (Mertz-PTT)
W91-06251

EFFECTS OF SUBSTRATE RELIEF ON THE DISTRIBUTION OF PERIPHYTON IN LABORATORY STREAMS. I. HYDROLOGY.
Oregon State Univ., Corvallis. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 2E.
W91-06254

EFFECTS OF SUBSTRATE RELIEF ON THE DISTRIBUTION OF PERIPHYTON IN LABORATORY STREAMS. II. INTERACTIONS WITH IRRADIANCE.
Oregon State Univ., Corvallis. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 2E.
W91-06255

RESPONSE OF ANABAENA FLOS-AQUAE (CYANOPHYTA) NITROGENASE ACTIVITY TO SUDDEN PHOSPHATE DEPRIVATION.
Kent State Univ., OH. Dept. of Biological Sciences.
B. L. Gerber, and C. E. Wickstrom.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 650-655, 1990. 4 fig, 1 tab, 34 ref.

Descriptors: *Algae, *Algal blooms, *Aphanizomenon, *Cyanophyta, *Eutrophic lakes, *Limnology, *Nitrogen fixation, *Phosphorus, Anabaena, Aquatic life, Ecology, Mesotrophic lakes.

Algal blooms consisting of nitrogen-fixing genera such as Anabaena and Aphanizomenon commonly occur in mesotrophic and eutrophic lakes and reservoirs. Correlative and experimental studies demonstrate a strong relation between development of cyanobacterial populations and phosphorus loadings in these systems. At the cellular level phosphorus may accumulate in polyphosphate bodies as a result of luxury consumption by blue-green algae including nitrogen-fixing species. Cultures of Anaebaena flos-aquae (Lyng.) Breb. were used to determine changes in nitrogenase activity (acetylene reduction) after external concentrations of phosphorus were lowered. Two days following immersion in phosphorus-free medium, nitrogenase activity had doubled and required 8 days to return to time zero levels. Subsequent long-term experiments showed that concentrations of soluble reactive phosphorus releases from the algae transferred into the phosphorus-free medium reached maximum levels by day 3 and returned to initial low values by days 7-10. Nitrogenase activity was always highest during the soluble reactive phosphorus release-reassimilation phase but steadily decreased after reassimilation was complete. Day 56 nitrogenase activity was 5-14% of initial activity. The data support the hypothesis that heterocyst and vegetative cell adensoine triphosphate (ATP) pools are discrete and suggest that the short-term effects of phosphorus removal as an aquatic restoration technique need further study. (Mertz-PTT)
W91-06257

WIDESPREAD OCCURRENCE OF HIGHLY BRANCHED ACYCLIC C20, C25 AND C30 HYDROCARBONS IN RECENT SEDIMENTS AND BIOTA -- A REVIEW.
Polytechnic South West, Plymouth (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2K.
W91-06263

SOME FACTORS AFFECTING DISTRIBUTION OF DIATOM ASSEMBLAGES IN PYRENEAN SPRINGS.
Barcelona Univ. (Spain). Dept. de Ecologia.
S. Sabater, and J. P. Roca.
Freshwater Biology FWBLAB, Vol. 24, No. 3, p 493-507, December 1990. 5 fig, 5 tab, 52 ref.

Descriptors: *Algae, *Ecology, *Pyrenees Mountains, *Species composition, *Springs, Chrysophyta, Diatoms, Flow velocity, Ionic strength,

Physicochemical properties, Population density, Spain, Spring water.

The composition and abundance of diatom assemblages were studied, together with physiographical and physicochemical variables in twenty-eight springs in the Central Pyrenees during the period of 1987-88. Characteristic groupings of diatom taxa were revealed by Principal Components Analysis. One group, made up of assemblages of the taxa Navicula cincta, Caloneis spp. and Nitzschia elliptica, is characteristic of springs with waters of high ionic strength. Certain diatom taxa are characteristic of hard water springs, either in quiet waters (Denticula tenuis, Achnanthes minutissima, Eunotia) or fast flowing ones (Fragilaria, Diatoma hiemale). Other taxa are representative of relatively quiet, soft water springs: Anomeoneis brachysira, Tabellaria flocculosa, Aulacoseira distans and Fragilaria vaucheriae. Five different spring types were identified, with respect to diatom assemblages, using discriminant analysis. The first consisted of high mountain springs with cold, fast waters and low ionic strength. The second group, distributed throughout the Pyrenees, had similar environmental characteristics to the first group but with intermediate water velocity and slightly higher mineral content. The third contained springs in calcareous regions of the Pyrenees, mainly slow-flowing and with hard waters. The fourth was composed of soft water springs, while the fifth consisted of two springs which were subject to stressful conditions (limitation of light, abundance of nitrates of high salinity). Ionic strength and current velocity appeared to be the dominant environmental factors affecting diatom distribution in Pyrenean springs. (Author's abstract)
W91-06270

INDIRECT EFFECTS OF FISH PREDATION ON CALCITE SUPERSATURATION, PRECIPITATION AND TURBIDITY IN A SHALLOW PRAIRIE LAKE.
North Dakota State Univ., Fargo. Dept. of Zoology.
M. A. Hanson, M. G. Butler, J. L. Richardson, and J. L. Arndt.
Freshwater Biology FWBLAB, Vol. 24, No. 3, p 547-556, December 1990. 7 fig, 39 ref.

Descriptors: *Calcite, *Ecology, *Fish, *Lakes, *Limnology, *Turbidity, Daphnia, Eutrophic lakes, Fishkill, Lake Christina, Lake ecology, Minnesota, Phytoplankton, Seston, Supersaturation.

Calcite saturation and seston composition were studied during 1987 and 1988 in a shallow, eutrophic hard water prairie lake (Lake Christina, Minnesota), one year before and one year after a lake-wide fish removal. In both years calcite saturation increased rapidly after all ice had thawed and it peaked during mid-summer to late summer, with the mineral saturation index of calcite sometimes exceeding 30. Removal of calcite from lake seston by gentle acidification of unfiltered water samples showed suspended calcite to be an important source of turbidity in the lake. The lake-wide fish removal produced detectable changes in the annual cycle of calcite saturation and precipitation. Increased grazing by Daphnia galeata and Daphnia pulex apparently reduced calcite saturation during early summer by suppressing the phytoplankton, and lowering the demand for carbon dioxide. Lower calcite precipitation, as well as direct removal of calcite by Daphnia grazing, probably contributed to the improvement in water transparency observed after the fish kill. (Author's abstract)
W91-06271

PHYSICOCHEMICAL FACTORS AFFECTING THE ABUNDANCE AND SPECIES RICHNESS OF FISHES IN THE CIMARRON RIVER.
Oklahoma Water Resources Board, Oklahoma City. Water Quality Div.
R. J. Reash, and J. Pigg.
Proceedings of the Oklahoma Academy of Science, Vol. 70, p 23-28, 1990. 1 fig, 2 tab, 15 ref.

Descriptors: *Ecology, *Fish, *Fish populations, *Physicochemical properties, *Rivers, *Species diversity, Biomass, Cimarron River, Conductivity, Dissolved oxygen, Flow rates, Oklahoma, Population density, Statistical analysis, Turbidity, Water temperature.

Factors influencing fish assemblage parameters (species richness, density, and biomass) were analyzed at seven sites along 811 km of the Cimarron River in Oklahoma using correlation and multiple regression techniques. The data were obtained by the Oklahoma State Department of Health during 1976-1986. Significant differences in dissolved oxygen, temperature, turbidity, conductivity, and flow rate were observed among sites, reflecting longitudinal changes in physiography, land use, and tributary influence. Fish assemblage parameters and physicochemical variables were more frequently correlated at upstream sites than at downstream sites. At upstream sites, fish species richness, density and biomass were positively correlated with typical low-flow conditions. These parameters increased when water velocity, average depth, flow rate, and turbidity decreased. The more harsh and extreme environmental conditions at upstream sites (e.g. in isolated pools during late summer, with little or no shading and non-point source pollution) and fewer potential biotic interactions may explain the more profound influence of a few variables on fish abundance and diversity in the Cimarron River. (Author's abstract)
W91-06278

ASPECTS OF THE NITROGEN CYCLE IN PEATLAND AND PLANTATION FOREST ECOSYSTEMS IN WESTERN IRELAND.
University Coll., Dublin (Ireland). Dept. of Environmental Resource Management.
E. P. Farrell.
Plant and Soil PLSOA2, Vol. 128, No. 1, p 13-20, 1990. 10 fig, 6 tab, 10 ref.

Descriptors: *Forest ecosystems, *Ireland, *Nitrogen cycle, *Peat, *Soil chemistry, *Soil-water-plant relationships, *Wetlands, Fertilizers, Forest soils, Marine climates, Nitrates, Nutrients, Phosphorus, Pine trees, Plant growth, Precipitation, Spruce trees.

Extensive plantation forests cover large areas of blanket peatland in western Ireland. Sites are characterized by the ombrotrophic nature of the peat and the often extreme maritime conditions prevailing. A study area was chosen which is located close to two coastlines and in consequence, ions of marine origin are dominant in the bulk precipitation. Mean annual nitrogen deposition is 2.26 kg/ha. Forestry development in the region dates from the early 1950s. Deficiency of phosphorus is universally encountered, sometimes accompanied by a shortage of nitrogen. A fertilizer experiment in the study area was maintained for 16 years. It was found that the principal response was to applied phosphorus and although nitrogen had a positive influence on growth in the early years, it was of little consequence in the longer term. Over 900 kg N/ha was accumulated in the forest floor. In a mineralization study of peat collected from plots fertilized 14 years previously, differences in total mineral nitrogen production between treatments were small, but in nitrogen-treated plots a higher proportion of the mineral nitrogen was as nitrate than in those which had not received fertilizer nitrogen. Throughfall measurements in pole-stage crops of Sitka spruce and lodgepole pine which had received no fertilizer nitrogen showed significantly greater quantities of nitrogen than bulk precipitation. (Author's abstract)
W91-06321

SEASONALITY OF DENITRIFICATION IN WATER-LOGGED ALDER STANDS.
Copenhagen Univ. (Denmark). Dept. of General Microbiology.
S. Struwe, and A. Kjoller.
Plant and Soil PLSOA2, Vol. 128, No. 1, p 109-113, 1990. 2 fig, 1 tab, 14 ref.

Descriptors: *Alder trees, *Denitrification, *Nitrogen cycle, *Soil chemistry, *Swamps, *Wetlands, Acetates, Acetylene, Gas chromatography, Ammonia, Nitrates, Nitrogen oxides, Seasonal variation, Waterlogging.

In the last decade many contributions have been made towards the understanding of the importance of denitrification. The introduction of the acetylene inhibition technique has facilitated gas chromatographic detection of nitrous oxide (N2O), which is the major end product of denitrification when acetylene is present. This technique was used to investigate denitrification in an alder stand, based on the presumption of a high nitrate turnover in the aerobic layers of the nitrogen-rich soil. It has been well described that the soil under alder has a high content of combined nitrogen and a high ammonia concentration. The actual and potential denitrification in an alder swamp was measured in situ. A bottle method with inserted serum bottles without bottoms was used to trap N2O escaping from the soil. Acetylene was added to the headspace as inhibitor to stop denitrification of N2O. Measurements were performed monthly and N2O was usually collected over a 24-hour period. Denitrification rates increased with addition of nitrate and acetate and denitrification continued for at least 48 hours. The annual denitrification rate was calculated from these monthly measurements. It was found that the denitrifying activity was very low in the winter season and highest in spring and summer. The annual denitrification rate in alder soil was 4.9 kg N/ha with acetylene as inhibitor (3 times the rate in non-inhibited plots) and 42.1 kg N/ha when acetate and nitrate were also added. The relation between the end products of denitrification N2O:N2 is 1:2 in the water-logged system. (Fish-PTT)
W91-06322

HYDROLOGY OF AN ACID WETLAND BEFORE AND AFTER DRAINING FOR AFFORESTATION, WESTERN NEW ZEALAND.
Forest Research Inst., Christchurch (New Zealand). Forest and Wildland Ecosystems Div.
For primary bibliographic entry see Field 4C.
W91-06553

SEDIMENTARY DATA BASE: AN APPRAISAL OF LAKE AND RESERVOIR SEDIMENT BASED STUDIES OF SEDIMENT YIELD.
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06719

INSHORE FISH YIELD POTENTIAL OF LAKE KARIBA, ZIMBABWE.
Zimbabwe Univ., Harare. Dept. of Biological Sciences.
N. A. G. Moyo.
African Journal of Ecology AJOEDE, Vol. 28, No. 3, p 227-233, September 1990. 3 fig, 2 tab, 9 ref.

Descriptors: *Fish harvest, *Fisheries, *Kariba Lake, *Lake fisheries, *Zimbabwe, Fish management, Model studies.

Four surplus yield models were used to estimate the yield potential of the Kariba inshore fishery. The classical methods gave maximum sustainable yield (MSY) values as high as 1333 t/y. These values are regarded as overestimates in view of the present average annual catch of 619.4 t/y. The Schnute (1978) model gave an MSY of 719 t/y and a failure index close to 1, indicating that the model does not fit the data well. Overestimation will be quite high in a fishery that has had a history of increasing yields, as the plot of yield against effort will always lie above the true equilibrium curves. Yields from the Kariba inshore fishery increased between 1962 and 1964 but have declined since then, suggesting that the magnitude of overestimation, at least for the classical approach, is not so high. Walter's (1986) graphical approach of fitting an approximate equilibrium yield curve to catch and effort predicts an MSY between 550 and 570 t/y. It is suggested that the Kariba inshore fishery on the Zimbabwean side should be managed within this range, in specific basins. (Author's abstract)
W91-06745

INFLUENCE OF SEASON ON THE BREAKDOWN OF SUBMERGED LEAVES.

Mohamed-I Univ., Oujda (Morocco). Dept. de Biologie.
H. Chergui, and E. Pattee.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 1-12, November 1990. 5 fig, 42 ref.

Descriptors: *Deciduous trees, *Decomposition, *Detritus, *Leaves, *Seasonal variation, *Temperature effects, Alder trees, Decomposing organic matter, Pond water, Poplar trees, Willow trees.

The influence of season and temperature on the breakdown of submerged leaves of three deciduous tree species, alder (Alnus glutinosa), poplar (Populus nigra), and willow (Salix sp.) was investigated. Nitrogen and phosphorous contents indicated that the leaves entering the water in summer and autumn were most readily colonized by microorganisms. Temperature influenced overall processing most clearly by its impact on leaching. Leaves entering the water in September had weight losses in the first two months of 59, 42, and 46%, for alder, poplar, and willow, respectively. During the next three months, they lost a further 23, 23, and 24% of initial weights. The later reduction of breakdown rate in natural conditions did not appear to be due to winter temperatures, but to the presence of the refractory components of the leaf skeleton (cellulose, lignin). It is concluded that leaf composition and texture were more important than temperature in determining leaf breakdown rate. (MacKeen-PTT)
W91-06751

COMPARISON OF THE DIETARY COMPOSITION OF EPILITHIC TRICHOPTERAN SPECIES IN A FIRST-ORDER STREAM.

Max-Planck-Inst. fuer Limnologie, Schlitz (Germany, F.R.). Limnologische Flussstation.
G. Becker.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 13-40, November 1990. 16 fig, 4 tab, 97 ref.

Descriptors: *Aquatic insects, *Diets, *Europe, *Foods, *Periphyton, *Stream biota, Breitenbach, Caddisflies, Ecology, First-order streams, Food chains, Larvae, Seasonal variation.

The dietary composition of six epilithic trichopteran species, each with a similar life cycle, was examined. In 1896 and 1987 the gut contents of later stage larvae were analyzed and comparisons were made between specimens sampled along the lower 2 km of a Central European first-order stream. Gut contents were classified into 9 components and quantified using image analysis. Statistical analysis revealed significant differences between the utilization of several food components by the six species considered, despite an overlap in their microhabitats and food resources. The gut contents of Drusus annulatus, Tinodes rostocki, and Micrasema longulum contained a high proportion of diatoms, whereas cyanobacteria were abundant in Apatania fimbriata and D. annulatus. There were fewer algae, but higher proportions of detritus, in Agapetus fuscipes and Silo pallipes. Seasonal variability in periphyton composition was partly reflected in the larval gut contents. A cluster analysis revealed three species groupings: A. fuscipes and S. pallipes showed the most distinct trophic niche overlap, followed by A. fimbriata and D. annulatus. T. rostocki and M. longulum were combined in one group at a lower similarity level. Significant differences between the utilization of several food components reduced the likelihood of any inter-specific competition for high quality food resources. (Author's abstract)
W91-06752

EFFECT OF ESCAPE REACTIONS ON THE QUANTITATIVE SAMPLING OF GRAVEL STREAM FAUNA.

Biological Station, Lunz am See (Austria).
For primary bibliographic entry see Field 7B.
W91-06753

DAPHNIA GROWTH AT DIFFERENT CONCENTRATIONS OF BLUE-GREEN FILAMENTS.

Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
Z. M. Gliwicz.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 51-65, November 1990. 5 fig, 5 tab, 44 ref.

Descriptors: *Algal blooms, *Aquatic animals, *Crustaceans, *Cyanophyta, *Daphnia, *Limnology, Aphanizomenon, Growth rates, Waterfleas.

Body growth rates in four Daphnia species (D. magna, D. pulicaria, D. hyalina and D. cucullata) decreased with increased concentration of Aphanizomenon filaments when animals were grown in batch cultures at high Scenedesmus food levels (0.3-0.5 mg C/L) in an artificial medium adequate for Aphanizomenon at 20 C. Growth rates became negative in high filament concentrations. The maximum filament concentration that allowed for positive growth rate was greater in the small-bodied D. cucullata and D. hyalina than in the large-bodied D. magna and D. pulicaria, supporting the notion that smaller species are less vulnerable to interference from algal filaments. The critical filament concentration was higher when estimated in the artificial medium diluted by membrane-filtered lake water, in which filaments were more susceptible to grazing by Daphnia. No tendency for growth rate of Daphnia to decrease with increased filament concentration was observed in diluted medium at low Scenedesmus food levels (<0.1 mg C/L). Different levels of readily available food, and different concentrations and physiological states of filaments in the field and experimental studies may be among reasons why cyanobacterial filaments do not always cause reduced assimilation and increased respiration in Daphnia. Otherwise, the filaments may result in halting growth and reproduction of Daphnia, eventually leading to its extinction. (Author's abstract)
W91-06754

HCO3(-) AS AN EXOGENOUS CARBON SOURCE FOR RUPPIA CIRRHOSA (PENTAGNA) GRANDE.

Institut de Recerca i Tecnologia Agroalimentaries, Barcelona (Spain).
J. Penuelas, and M. Menendez.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 89-96, November 1990. 3 fig, 19 ref.

Descriptors: *Aquatic plants, *Bicarbonates, *Carbon, *Photosynthesis, Alkaline water, Alkalinity, Carbon dioxide, Energy sources, Saline water, Salinity.

The aquatic plant Ruppia cirrhosa was investigated for its ability to utilize bicarbonate and carbon dioxide as exogenous carbon sources for photosynthesis. In sodium bicarbonate solutions, R. cirrhosa increased the pH to a maximum of 9.85, corresponding to a carbon dioxide compensation point of 0.55 mmol/cu m of carbon dioxide. Measured photosynthetic rates cannot be explained by carbon dioxide uptake alone. Photosynthetic rates decreased at high pH but did not decline to zero until pH 11.5. Furthermore, photosynthesis was increased by higher bicarbonate concentrations at constant carbon dioxide concentration. It is concluded that Ruppia cirrhosa has the capability to utilize bicarbonate, which helps to explain its wide distribution in alkaline saline waters. (Author's abstract)
W91-06756

MACROPHYTE INFLUENCES ON THE ZONATION OF SEDIMENT ACCRETION AND COMPOSITION IN A NORTH-TEMPERATE RESERVOIR.

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2J.
W91-06759

OBSERVATIONS ON THE PHYTOBENTHOS OF THE FRESHWATER THAMES: III. THE FLORISTIC COMPOSITION AND SEASONALITY OF ALGAE IN THE TIDAL AND NON-TIDAL RIVER.

British Museum of Natural History, London (England). Dept. of Botany.
D. M. John, L. R. Johnson, and J. A. Moore.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 2, p 143-168, December 1990. 14 fig, 8 tab, 32 ref, append.

Descriptors: *Algae, *Ecology, *England, *Estuaries, *Rivers, *Thames River, *Tidal rivers, Population density, Seasonal variation, Species composition.

The floristic composition, seasonality, and distribution of algae were studied using plastic surfaces placed in the freshwater tidal Thames and in the non-tidal river. Surfaces placed in the tidal river were subjected to twice daily emersion, unlike those positioned above the influence of the tides. With the exception of some members of the Cyanophyceae, the majority of the algae were more frequent on surfaces placed in the non-tidal river and a few were not detected downriver in the tidal stretch. Desiccation during emersion, heavy siltation and water movement are considered to be the most important factors influencing the assemblage of algae found on surfaces placed in the freshwater tidal river, here defined as the stretch sandwiched between the brackish water estuary and the non-tidal river. (Author's abstract)
W91-06760

COEXISTENCE OF DAPHNIA SPECIES AND THEIR HYBRIDS: AN EXPERIMENTAL POPULATION GENETICS APPROACH.

Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.). Abt. Oekophysiologie.
M. A. Mort.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 2, p 169-183, December 1990. 4 fig, 5 tab, 23 ref.

Descriptors: *Aquatic animals, *Genetics, *Germany, *Lake ecology, *Lakes, *Limnology, Algae, Competitive exclusion, Daphnia, Nutrition, Population dynamics, Schohsee, Species composition, Waterfleas.

The ecological relationships in a Daphnia species assemblage (D. galeata, D. hyalina, and galeata x hyalina hybrids) were studied in Schohsee, a large permanent lake in northern Germany. The populations were manipulated in in situ experiments, in which the laboratory-grown green alga Scenedesmus was added to large-scale enclosures (1500 L). Responses were monitored using genotypes at the Pgm and Got loci. In four experiments of 40-57 day duration, D. hyalina exhibited relative increases in enclosures receiving algae while hybrids underwent steady increases in enclosures both with and without added algae. These results are in part consistent with the argument that slight differences in resource utilization exist among the Daphnia species considered here and that these differences are masked by environmental fluctuations. (Author's abstract)
W91-06761

SENSITIVITY OF TWO CLADOCERANS TO WATER QUALITY VARIABLES: SALINITY AND HARDNESS.

Dow Chemical Co., Midland, MI. Environmental Toxicology and Chemistry Research Lab.
For primary bibliographic entry see Field 5C.
W91-06762

CARBON ISOTOPE DISCRIMINATION BY PHYTOPLANKTON AND PHOTOSYNTHETIC BACTERIA IN MONOMICTIC LAKE FUKAMI-IKE.

Nagoya Univ. (Japan). Water Research Inst.
K. Takahashi, E. Wada, and M. Sakamoto.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 2, p 197-210, December 1990. 6 fig, 3 tab, 28 ref. Ministry of Education, Science, and Culture Grant 63540519.

Descriptors: *Aquatic bacteria, *Carbon, *Carbon radioisotopes, *Japan, *Lakes, *Limnology, *Phytoplankton, *Radioisotopes, *Tracers, Isotope studies, Lake Fukami-ike, Organic carbon, Photosynthetic bacteria.

Carbon isotope ratios of particulate, settling, and sedimentary organic carbon, and dissolved inorganic carbon (DIC) were analyzed to study the eco-physiology of phytoplankton and photosynthetic bacteria (green sulfur bacteria) and the fate of organic matter in Lake Fukami-ike, Japan. Carbon isotope ratios of particulate organic carbon (POC) decreased from -24.8 through -17.8 ppt at the water surface to -29.2 through -23.6 ppt at 8 m depth, while those of DIC increased with depth and ranged from -17.7 to -4.4 ppt. Calculated carbon isotope discrimination between POC and bicarbonate in the euphotic zone, which can provide long-term integrated information on the kinetic mode of photosynthesis, ranged from 0.3 to 21.3 and increased with depth, indicating a relatively high photosynthetic rate at the surface. Discriminations by the photosynthetic bacteria at 5 m depth were consistently larger than those by surface phytoplankton. This finding suggested that photosynthetic bacterial populations had grown at a slow rate in Lake Fukami-ike from June to July 1988, consistent with low carbon and nitrogen uptake rates in tracer experiments. The high delta C-13 values of DIC in deeper layers seem to result partly from isotope fractionation in the process of methane production in this lake. (Author's abstract)
W91-06763

PRODUCTIVITY, DIET, AND ENVIRONMENTAL CONTAMINANTS IN BALD EAGLES NESTING NEAR THE WISCONSIN SHORELINE OF LAKE SUPERIOR.
Wisconsin Univ.-Stevens Point. Coll. of Natural Resources.
For primary bibliographic entry see Field 5C.
W91-06774

EFFECT OF HERBICIDE RESIDUES ON MICROBIAL PROCESSES IN POND SEDIMENT.
Clemson Univ., SC. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W91-06777

BIOMAGNIFICATION OF POLYCHLORINATED BIPHENYLS, TOXAPHENE, AND DDT COMPOUNDS IN A LAKE MICHIGAN OFFSHORE FOOD WEB.
Michigan Univ., Ann Arbor. Center for Great Lakes and Aquatic Sciences.
For primary bibliographic entry see Field 5B.
W91-06778

GENETIC DAMAGE IN A POPULATION OF SLIDER TURTLES (TRACHEMYS SCRIPTA) INHABITING A RADIOACTIVE RESERVOIR.
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5C.
W91-06784

DISTRIBUTION AND ABUNDANCE OF LARVAL COQUILLETTIDIA PERTURBANS IN A FLORIDA FRESHWATER MARSH.
Polk County Board of Commissioners for Environmental Services, Bartow, FL.
C. D. Morris, J. L. Callahan, and R. H. Lewis.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 3, p 452-460, September 1990. 8 tab, 31 ref.

Descriptors: *Florida, *Insect control, *Larvae, *Mosquitoes, *Population density, Marsh management, Marsh plants, Marshes, Wetlands.

Studies are being conducted in Florida to determine the spatial distributions of all larval instars of Coquillettidia pertubans and the factors that influence these distributions as part of an effort to develop control programs. All instars of larval Coquillettidia perturbans were found in the same habitats, but early instar larvae were more aggregated than later instars. Larvae were most numerous in areas dominated by arrow-arum and maidencane, less so in areas dominated by sedges and miscellaneous mixed vegetation, and least abundant in pickerelweed areas. Larvae were uncommon in open water 35-70 cm deep. There was also a tendency for them to concentrate in areas beyond 25 m from shore. Larvae were log-normally distributed in favorable sites and became progressively more aggregated as sites became less favorable. Since larval aggregation is related to vegetation, water depth and proximity to the marsh edge some control could be achieved by managing aquatic vegetation and water depth. While this approach may not be possible in natural marshes, it is possible in manmade, restored, or enhanced wetlands projects, including lake shores. (Doyle-PTT)
W91-06824

EFFECTS OF CONTROLLED BURNING ON AEDES TAENIORHYNCHUS EGGS IN AN ABANDONED RICE IMPOUNDMENT IN SOUTH CAROLINA.
Citadel, Charleston, SC.
For primary bibliographic entry see Field 4A.
W91-06826

GREAT LAKES ESTUARIES.
Ohio State Univ., Columbus. Dept. of Zoology.
C. E. Herdendorf.
Estuaries ESTUDO, Vol. 13, No. 4, p 493-503, December, 1990. 3 fig, 3 tab, 27 ref.

Descriptors: *Estuaries, *Great Lakes, *Lake morphology, *Lakes, Influent streams, Lake classification, River mouth.

Like oceans, large lakes can possess estuarine-like environments. An estuary is distinguished from other bodies of water by three characteristics: (1) it is a coastal feature with some constriction at its opening to the sea; (2) it has a free connection to the sea to permit continuous exchange of water; (3) and there is a mixing of two kinds of water. These three basic concepts can logically be applied to the Great Lakes where the lower courses of many tributaries are characterized by drowned or estuarine like stream mouths, where river water is mixed with that of the lakes. The role of Old Woman Creek estuary in ameliorating storm-water flow enroute to Lake Erie demonstrates functional similarity to brackish water estuaries by acting as a chemical processor which retains 12-60% of the metals and 35-80% of the biologically important nutrients before discharging into the lake. The termination of Wisconsinian glaciation, which resulted in a eustatic rise in sea level of 100 m and in the formation of such Atlantic coast estuaries as the Chesapeake and Delaware Bays, also resulted in isostatic rebound and the formation of drowned river valleys or rias in the Great Lakes region. Based on analysis of literature and field observation, it is proposed that the term freshwater or Great Lakes estuary be applied to the drowned potion of the streams entering the Great Lakes. (Doyle-PTT)
W91-06846

CHANGE IN C:N:P RATIOS DURING PASSAGE OF WATER AREAS FROM RIVERS TO A LAKE.
National Inst. for Environmental Studies, Tsukuba (Japan). Water and Soil Environment Div.
For primary bibliographic entry see Field 5B.
W91-06870

ACUTE TOXICITIES TO LARVAL RAINBOW TROUT OF REPRESENTATIVE COMPOUNDS DETECTED IN GREAT LAKES FISH.
National Fisheries Research Center-Great Lakes, Ann Arbor, MI.
For primary bibliographic entry see Field 5C.
W91-06882

USING LAKE TROUT AS A SURROGATE OF ECOSYSTEM HEALTH FOR OLIGOTROPHIC WATERS OF THE GREAT LAKES.
North Central Forest Experiment Station, Rhinelander, WI. Forestry Sciences Lab.
For primary bibliographic entry see Field 5A.
W91-06923

ECOSYSTEM HEALTH, A HUMAN PERCEPTION: DEFINITION, DETECTION, AND THE DICHOTOMOUS KEY.
Ontario Ministry of Natural Resources, Thunder Bay. Fisheries Research Section.
For primary bibliographic entry see Field 5G.
W91-06925

NEW STRATEGIES FOR GREAT LAKES TOXICOLOGY.
International Joint Commission-United States and Canada, Windsor (Ontario).
For primary bibliographic entry see Field 5A.
W91-06926

FISH COMMUNITY HEALTH ASSESSMENT: A USEFUL CONCEPT.
Institut Maurice-Lamontagne, Mont-Joli (Quebec).
For primary bibliographic entry see Field 5A.
W91-06927

COMMENTARY ON FISH COMMUNITY HEALTH: MONITORING AND ASSESSMENT IN LARGE LAKES.
Case Western Reserve Univ., Cleveland, OH. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W91-06928

DETERMINING THE HEALTH OF FISH COMMUNITIES: PARALLELS WITH HUMAN MEDICINE.
Wilfrid Laurier Univ., Waterloo (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W91-06929

OBSERVATIONS ON FISH COMMUNITY HEALTH.
Environmental Protection Agency, Chicago, IL. Great Lakes National Program Office.
For primary bibliographic entry see Field 5A.
W91-06930

ASSESSMENT AND MANAGEMENT OF FISH COMMUNITY HEALTH IN THE GREAT LAKES: SYNTHESIS AND RECOMMENDATIONS.
Ontario Ministry of Natural Resources, Maple. Fisheries Branch.
For primary bibliographic entry see Field 5A.
W91-06931

POREWATER OXIDATION, DISSOLVED PHOSPHATE AND THE IRON CURTAIN: IRON-PHOSPHORUS RELATIONS IN TIDAL FRESHWATER MARSHES.
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2K.
W91-06944

METHANE PRODUCTION AND SULFATE REDUCTION IN TWO APPALACHIAN PEATLANDS.
Villanova Univ., PA. Dept. of Biology.
R. K. Wieder, J. B. Yavitt, and G. E. Lang.
Biogeochemistry BIOGEP, Vol. 10, No. 2, p 81-104, 1990. 9 fig, 1 tab, 64 ref. NSF Grants BSR-8215731 and BSR-8516700, and NASA Grant NAGW-842.

Descriptors: *Acid rain, *Bogs, *Methanogenesis, *Peat, *Sulfur compounds, Anaerobic conditions, Carbon, Cores, Freshwater, Mineralization, Oxidation, Sphagnum, Watersheds.

Anaerobic carbon mineralization was evaluated over a 1-year period in two Sphagnum-dominated

peatlands, Big Run Bog, West Virginia, and Buckle's Bog, Maryland. The coring technique used caused minimal disturbance and was effective in preserving any vertical stratification present in the peat deposit. The measurements of anaerobic methane and carbon dioxide production were made on anaerobic slurries in which peatland interstitial water was added to peat samples from each depth. Rates of methane production were similar to rates reported for other freshwater peatlands, but methane production accounted for only 11.7 and 2.8%, respectively, of the total anaerobic carbon mineralization at these two sites. Carbon dioxide production, resulting substantially from sulfate reduction, dominated anaerobic carbon mineralization. Considerable sulfate reduction, despite low instantaneous dissolved sulfate concentrations (typically < 300 micromole/L of substrate), was apparently fueled by oxidation and rapid turnover of the reduced inorganic sulfur pool. The coincidence of high sulfate inputs to the two watersheds through acid precipitation with the unexpected importance of sulfate reduction leads to the suggestion of a new hypothesis: peatlands not receiving high sulfate loading should exhibit low rates of anaerobic decomposition, and a predominance of methane production over sulfate reduction; however, if such peatlands become subjected to high rates of sulfur deposition, sulfate reduction may be enhanced as an anaerobic mineralization pathway with attendant effects on carbon balance and peat accumulation. (Author's abstract)
W91-06946

CUMULATIVE EFFECT OF WETLANDS ON STREAM WATER QUALITY AND QUANTITY: A LANDSCAPE APPROACH.
Minnesota Univ.-Duluth. Natural Resources Research Inst.
C. A. Johnston, N. E. Detenbeck, and G. J. Niemi.
Biogeochemistry BIOGEP, Vol. 10, No. 2, p 105-141, 1990. 5 fig, 8 tab, 67 ref. U.S. EPA Grants EPA CR-814083-010 and EPA CR-81548-0102.

Descriptors: *Marshes, *Streams, *Water quality management, *Wetlands, Chemical properties, Land use, Model studies, Nitrogen compounds, Organic matter, Phosphorus, Physical properties, Resources management, Seasonal variation, Suspended solids.

A method was developed to evaluate the cumulative effect of wetland mosaics in the landscape on stream water quality and quantity in the nine-county region surrounding Minneapolis-St. Paul, Minnesota. A Geographic Information System was used to record and measure 33 watershed variables derived from historical aerial photos. These watershed variables were then reduced to eight principal components which explained 86% of the variance: (1) wetland extent; (2) wetland proximity, watershed area; (3) land use (agricultural/urban); (4) 3rd order streams, watershed diversity, soil pH; (5) forested stream fringe; (6) elongated headwater watersheds; (7) soil erodibility, forest; and (8) herbaceous marsh extent. Relationships between stream water quality variables and the three wetland-related principal components were explored through stepwise multiple regression analysis. The proximity of wetlands to the sampling station was related to principal component two, which was associated with decreased annual concentrations of inorganic suspended solids, fecal coliform, nitrates, specific conductivity, flow-weighted NH4, flow-weighted total P, and a decreased proportion of phosphorus in dissolved form ($p < 0.05$). Wetland extent was related to decreased specific conductivity, chloride, and lead concentrations. The wetland-related principal components were also associated with the seasonal export of organic matter, organic nitrogen, and orthophosphate. Relationships between water quality and wetlands components were different for time-weighted averages as compared to flow-weighted averages. This suggests that wetlands were more effective in removing suspended solids, total phosphorus, and ammonia during high flow periods but were more effective in removing nitrates during low flow periods. (Author's abstract)
W91-06947

EFFECTS OF SUBSTRATE ON DENSITY OF AQUATIC INSECTS IN A SOUTHEAST NEBRASKA STREAM.
Nebraska Univ.-Lincoln. Dept. of Entomology.
For primary bibliographic entry see Field 2E.
W91-07008

IN SITU VOLTAMMETRIC MEASUREMENT OF TRACE ELEMENTS IN LAKES AND OCEANS.
Geneva Univ. (Switzerland). Dept. de Chimie Minerale, Analytique et Appliquee.
For primary bibliographic entry see Field 5A.
W91-07016

MODEL EXPERIMENTS ON BED LOAD TRANSPORT IN THE VARIABLE BACKWATER ZONE OF A RESERVOIR.
Chengdu Univ. of Science and Technology (China). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 2J.
W91-07063

SUSPENDED SEDIMENT ROUTING ALONG A RESERVOIR.
Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ingenieria.
For primary bibliographic entry see Field 2J.
W91-07070

LAKE-CATCHMENTS: AN EVALUATION OF THEIR CONTRIBUTION TO STUDIES OF SEDIMENT YIELD AND DELIVERY PROCESS.
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-07101

AVERAGE LONG-TERM SEDIMENT DISCHARGE INVESTIGATIONS BASED ON RESERVOIR RESURVEY DATA AND SEDIMENT YIELD RATE FACTORS.
Fundacao Centro Tecnologico de Minas Gerais (Brazil).
For primary bibliographic entry see Field 2J.
W91-07102

ESTIMATION OF COLLUVIAL RESERVOIR LIFE FROM SEDIMENT BUDGETING, KATIORIN EXPERIMENTAL BASIN, KENYA.
Toronto Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-07114

SEDIMENT YIELD AND AVAILABILITY FOR TWO RESERVOIR DRAINAGE BASINS IN CENTRAL LUZON, PHILIPPINES.
Hydraulics Research Ltd., Wallingford (England). Overseas Development Unit.
For primary bibliographic entry see Field 2J.
W91-07116

2I. Water In Plants

WILLIAM A. CANNON: THE SONORAN DESERT'S FIRST RESIDENT ECOLOGIST.
Geological Survey, Tucson, AZ.
For primary bibliographic entry see Field 6G.
W91-06008

COMBINED EFFECTS OF LEACHING FRACTION, SALINITY, AND POTASSIUM CONTENT OF WATERS ON GROWTH AND WATER-USE EFFICIENCY OF WHEAT AND BARLEY.
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W91-06311

SOIL WATER DYNAMICS, TRANSPIRATION, AND WATER LOSSES IN A CRESTED WHEATGRASS AND NATIVE SHORTGRASS ECOSYSTEM.
Colorado State Univ., Fort Collins. Dept. of Range Science.
M. J. Trlica, and M. E. Biondini.
Plant and Soil PLSOA2, Vol. 126, No. 2, p 187-201, 1990. 8 fig, 3 tab, 46 ref. NSF Grant No. BSR-8405604 and Colorado Agriculture Experiment Station Project 100.

Descriptors: *Grasses, *Plant water potential, *Soil water, *Soil-water-plant relationships, *Wheatgrasses, Leaves, Plant growth, Roots, Soil moisture deficiency, Soil water potential, Transpiration, Water loss, Water use.

Numerous crested wheatgrass communities have been established with little or no apparent succession for more than 40 years in the western U.S and Canada. Few studies have elucidated the persistence of crested wheatgrass in the shortgrass steppe environment. The status of water in soil and vegetation was monitored in a stand of crested wheatgrass and a nearby shortgrass steppe during a growing season in Wyoming, in order to determine if water use and losses were similar among two very different communities in a similar climate. The native shortgrass community with greater root biomass had consistently greater soil water depletion in the deeper soil horizons than was found in the crested wheatgrass community, suggesting that they might be more competitive than crested wheatgrass in a water-limited environment. Crested wheatgrass maintained a high leaf water potential early in the season, but lower water potential and leaf conductance (and thus seasonal transpiration) during the latter part of the growing season as compared with the major shortgrass species, blue grama, and western wheatgrass. Water loss through transpiration was less for western wheatgrass, with less leaf area, than for either blue grama or crested wheatgrass. However, western wheatgrass was as efficient as the other species in its use of water. Crested wheatgrass transpired more water than blue grama early in the growing season, but less than either native species for the remainder of the growing season. Estimated seasonal transpiration loss was greater in the shortgrass ecosystem than in the established crested wheatgrass stand. The different water use patterns suggest that wet, cool spring seasons should favor crested wheatgrass; summertime thunderstorms might be more effectively used by native shortgrass species. (Fish-PTT)
W91-06314

SOIL PHYSICAL BEHAVIOUR AND CROP RESPONSES TO TILLAGE IN LOWLAND RICE SOILS OF VARYING CLAY CONTENT.
International Rice Research Inst., Los Banos, Laguna (Philippines).
For primary bibliographic entry see Field 3F.
W91-06315

RICE HULL AND CARYOPSIS DISCOLORATION DISEASES: I. SEVERITY AND INCIDENCE IN THREE ECOSYSTEMS IN WEST AFRICA.
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Dobson, and I. W. Buddenhagen.
Plant and Soil PLSOA2, Vol. 127, No. 1, p 97-101, 1990. 3 fig, 13 ref.

Descriptors: *Available water, *Grain crops, *Nigeria, *Plant diseases, *Rice, *Soil-water-plant relationships, Africa, Agricultural hydrology, Ecosystems, Fertilizers, Herbicides, Phreatophytes, Plant growth, Soil properties, Soil water, Wetlands.

In West Africa, rice is grown in three contrasting ecosystems: upland, phreatic, and lowland, which is characterized by differing water availability and soil properties. These ecosystems influence the predisposition of rice to disease problems, including the grain discoloration complex. A study was undertaken to determine, for both upland and lowland-adapted cultivars, the severity of each of the two diseases in the three ecosystems. In 1983 and

1984 five rice cultivars were grown in a randomized complete block design with four replications in the three ecosystems located at different sites. The irrigated lowland site was puddled and ammonium sulfate, P2O5, and potassium chloride were applied. The upland and phreatic sites were sprayed with a contact herbicide and a fertilizer. At maturity, a random 200 grain sample of each cultivar was collected from each replication. After being rated for hull discoloration, the grains in each category were hulled and the caryopses rated as clean or discolored. It was found that discoloration of the hull was most severe in the upland, less in the phreatic, and least in the water-saturated lowland ecosystem. Caryopsis discoloration, however, showed no consistent pattern in relation to the three ecosystems and was not correlated with hull discoloration, indicating that other factors are involved. (See also W91-06319) (Fish-PTT)
W91-06318

RICE HULL AND CARYOPSIS DISCOLORATION DISEASES: II. EFFECTS OF SOIL AND SOIL WATER ON HULL DISEASE AT TWO SITES IN NIGERIA.
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Dobson, and K. Aluri.
Plant and Soil PLSOA2, Vol. 127, No. 1, p 103-106, 1990. 3 tab, 8 ref.

Descriptors: *Africa, *Agricultural hydrology, *Available water, *Nigeria, *Plant diseases, *Rice, *Soil-water-plant relationships, Climatic zones, Drainage effects, Soil properties, Soil saturation, Soil water.

In West Africa, discoloration of the rice hull is influenced by water availability and soil properties. These two critical environmental factors were examined in controlled pot experiments in contrasting environments. It was found that coarse upland soils and free-draining soil-water regimes increased hull discoloration and disease severity, while lowland soils and water saturation minimized disease severity. However, with all soils tested, the humid, high-rainfall environment of Southeast Nigeria was found to increase hull discoloration in comparison to the drier West Nigerian environment. (See also W91-06138) (Author's abstract)
W91-06319

DISSOLVED INORGANIC NITROGEN CONCENTRATIONS AND FLUXES IN THREE BRITISH SITKA SPRUCE PLANTATIONS.
Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
For primary bibliographic entry see Field 5B.
W91-06323

RAINFALL DISTRIBUTION UNDER A CORN CANOPY: IMPLICATIONS FOR MANAGING AGROCHEMICALS.
National Soil Tilth Lab., Ames, IA.
For primary bibliographic entry see Field 3F.
W91-06401

EFFICIENCY OF NITROGEN USE BY DRYLAND WHEAT IN A SUBHUMID REGION IN RELATION TO OPTIMIZING THE AMOUNT OF AVAILABLE WATER.
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 3F.
W91-06417

TRANSPIRATION OF MATURE STANDS OF SPRUCE (PICEA ABIES (L.) KARST.) AS ESTIMATED BY THE TREE-TRUNK HEAT BALANCE METHOD.
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Inst. of Forest Ecology.
For primary bibliographic entry see Field 2D.
W91-06539

ESTIMATING WATER USE BY EUCALYPTUS GRANDIS WITH THE PENMAN-MONTEITH EQUATION.
South African Forestry Research Inst., Sabie.
For primary bibliographic entry see Field 2D.
W91-06541

EFFECT OF SURROUNDING TOPOGRAPHY ON RECEIPT OF SOLAR RADIATION.
Geological Survey, Mercury, NV. Water Resources Div.
A. L. Flint, and S. W. Childs.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 339-347, 6 fig, 12 ref.

Descriptors: *Forest hydrology, *Plant growth, *Productivity, *Solar radiation, *Topography, Albedo, Atmosphere, Forest watersheds, Hydrologic models, Model studies, Snow cover, Terrain analysis, Trees.

Solar radiation is a major factor controlling forest site productivity and tree growth. Characteristics of radiation receipt in basins can be measured or modeled. The modeling approach is of particular value when site specific data are not available or when estimates are required for a large number of sites. A study was performed to assess the annual solar radiation on sites in terrain where surrounding ridges and tall ridges and tall trees block both direct beam and sky diffuse short wave radiation. The model used accounts for topographic blocking of direct beam radiation, anisotropic diffuse radiation, and ground-reflected radiation. Model results show the importance of various components of short wave radiation at a site. Ground-reflected radiation averages 8% throughout the year but makes a larger contribution (15%) in winter when snow cover increases ground albedo. Circumsolar diffuse radiation comprises about 7% of the total radiation but is as large as 15% during the summer months when increased atmospheric turbidity increases aerosol-scattered radiation. The decline in direct beam radiation during the summer is due to decreased atmospheric transmission. Although direct beam radiation is the major component it only contributes about half of the total radiation in January when isotropic diffuse and ground-reflected radiation components are large. The contribution of ground-reflected and isotropic diffuse radiation is important in steep terrain when direct beam and circumsolar diffuse radiation is blocked. Comparisons among sites are less dramatic than those made with models that do not account for changing atmospheric and ground albedo conditions. The model may be used to calculate radiation receipt for an entire basin. (See also W91-06510) (Fish-PTT)
W91-06542

USE OF LYSIMETER MEASUREMENTS FOR ESTIMATION OF THE EVAPOTRANSPIRATION OF PINE FOREST BY BAGROV'S METHOD.
Humboldt-Univ. zu Berlin (German D.R.). Sektion Physik.
For primary bibliographic entry see Field 2D.
W91-06544

SOIL WATER BALANCE MODEL FOR PARTITIONING WATER USE AMONG CROP TREES, EVAPORATION, AND COMPETING VEGETATION.
Oregon State Univ., Corvallis. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W91-06547

TURGOR MAINTENANCE IN ROSA RUGOSA GROWN AT THREE LEVELS OF NITROGEN AND SUBJECTED TO DROUGHT.
Tennessee Univ., Knoxville. Dept. of Ornamental Horiculture and Landscape Design.
For primary bibliographic entry see Field 3F.
W91-06918

EFFECT OF PATTERN OF WATER SUPPLY ON VICIA FABA L.: 1. DRY MATTER PARTITIONING AND YIELD VARIABILITY.
Centre for Agrobiological Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 3F.
W91-06932

MOISTURE DISTRIBUTION WITHIN A MAIZE CROP DUE TO DEW.
Agricultural Univ., Wageningen (Netherlands). Dept. of Meteorology.
A. J. Atzema, A. F. G. Jacobs, and L. Wartena.
Netherlands Journal of Agricultural Science NETMAW, Vol. 38, No. 2, p 117-129, 1990. 8 fig, 1 tab, 21 ref.

Descriptors: *Corn, *Dew, *Moisture profiles, *Soil-water-plant relationships, Canopy, Condensation, Crop production, Dewpoint, Distribution, Energy, Soil properties, Soil water, Temperature, Temperature gradient.

During 16 nights in September and October 1986, the process of dew formation was studied within a maize crop. With the Bowen ratio energy balance technique the total dewfall from above the canopy was measured. By estimating the soil characteristics and measuring the soil moisture and temperature gradients of the topsoil, an assessment of the dewrise from the soil could be made. To estimate the distribution of free water within the crop, the liquid water profile was measured with Leick plates at 5 levels. Dewfall proved to contribute most to the total dew deposition. As an average for the experimental period, nearly 5% could be attributed to dewrise and 95% could be attributed to dewfall. On the 10 occasions, the total amount of dew ranged between 0.01 and 0.41 mm per night. To obtain a simple but rough indication of the amount of dew, the difference between the minimum and midday dewpoint temperature could be applied, or, if the soil was well watered, the topsoil temperature gradient could be applied. (Author's abstract)
W91-06933

EFFECT OF PATTERN OF WATER SUPPLY ON VICIA FABA L.: 2. POD RETENTION AND FILLING, AND DRY MATTER PARTITIONING, PRODUCTION AND WATER USE.
Centre for Agrobiological Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 3F.
W91-06934

CONTRIBUTION OF OSMOTIC ADJUSTMENT TO GRAIN YIELD IN SORGHUM BICOLOR (L.) MOENCH UNDER WATER-LIMITED CONDITIONS: I. WATER STRESS BEFORE ANTHESIS.
Queensland Univ., Brisbane (Australia). Dept. of Agriculture.
J. M. Santamaria, M. M. Ludlow, and S. Fukai.
Australian Journal of Agricultural Research AJAEA9, Vol. 41, No. 1, p 51-65, 1990. 2 fig, 7 tab, 24 ref.

Descriptors: *Anthesis, *Crop yield, *Drought, *Grain crops, *Osmoregulation, *Soil-water-plant relationships, *Sorghum, *Water stress, Agriculture, Field tests, Membrane processes, Plant growth.

The contribution of osmotic adjustment to grain yield in Sorghum bicolor (L.) Moench was studied using six varieties. Three of the varieties (Goldrush, E57, and DK470) were selected for high osmotic adjustment and the other three (Texas 610SR, Texas 671, and SC 219-9-19-1) for low osmotic adjustment. They were divided into early, intermediate and late maturity groups. The plants were either well watered, or subjected to a 41-day period of water shortage prior to anthesis and well watered for the remainder of their growth. The varieties selected for higher osmotic adjustment developed higher levels of osmotic adjustment in intermediate and late maturity groups, but not in the early group. However, the level of osmotic adjustment was not related to the maturity group, when water stress was imposed at the same developmental stage. Varieties with high osmotic adjust-

ment produced higher grain yields than those with low osmotic adjustment. The higher mean grain yield was due mainly to a larger grain number (19%). Even though varieties with high osmotic adjustment had a greater root length, soil water extraction and dry matter production during the pre-anthesis stress period, there was no significant difference in dry matter yield at physiological maturity between low and high adjustment groups. Consequently, the higher mean grain yield was related solely to a higher harvest index (27%), which was associated with a higher distribution index (25%) and a higher grain number (19%). There appears to be at least two pathways in which higher levels of osmotic adjustment contributed to higher grain number of sorghum subjected to water stress prior to anthesis. Moreover, there appears to be a clear linkage between higher grain numbers and grain yield via higher distribution indices and higher harvest indices. It is believed that this scheme is consistent with, though not proof of, a causal relationship between osmotic adjustment and grain yield of sorghum grown under water-limiting conditions before anthesis. (See also W91-06942) (Author's abstract)
W91-06941

CONTRIBUTION OF OSMOTIC ADJUSTMENT TO GRAIN YIELD IN SORGHUM BICOLOR (L.) MOENCH UNDER WATER LIMITED CONDITIONS: II. WATER STRESS AFTER ANTHESIS.
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
M. M. Ludlow, J. M. Santamaria, and S. Fukai.
Australian Journal of Agricultural Research AJAEA9, Vol. 41, No. 1, p 67-78, 1990. 3 fig, 4 tab, 16 ref.

Descriptors: *Anthesis, *Crop yield, *Grain crops, *Osmoregulation, *Soil-water-plant relationships, *Sorghum, *Water stress, Agriculture, Field tests, Membrane processes, Plant growth.

The contribution of osmotic adjustment to grain yield in Sorghum bicolor (L.) subjected to water stress between anthesis and maturity was studied using six varieties. Three of the varieties (Goldrush, E57, and DK470) were selected for high osmotic adjustment and the other three (Texas 620SR, Texas 671, and SC 219-9-19-1) for low osmotic adjustment. They were divided into early, intermediate and late maturity groups. The plants were either well watered or subjected to a 50-day period of water shortage after anthesis following being well watered prior to anthesis. Varieties selected for high osmotic adjustment had mean values of osmotic adjustment at the end of the post-anthesis stress that were more than double those selected for low osmotic adjustment. The corresponding mean grain yield of varieties with high osmotic adjustment were 24% higher than that of varieties with low osmotic adjustment. The higher yield was due to both more and larger grains, and it was associated with higher harvest index and distribution index. At best, the difference in dry matter at maturity could explain only a few percent of the difference in grain yield between varieties with low and high osmotic adjustment. Water stress prior to anthesis was previously shown to reduce yield more than a post-anthesis stress of the same intensity. However, osmotic adjustment was equally effective in minimizing the reduction in grain yields in both stages. It is concluded that osmotic adjustment can be used as a selection trait in programs to improve the yield of grain sorghum. The main obstacles to incorporating osmotic adjustment are the development of procedures to impose reproducible stresses and of rapid methods to measure the level of osmotic adjustment, and knowledge of inheritance of the trait. (See also W91-06941) (Author's abstract)
W91-06942

RHIZOSPHERE PH AND ALUMINUM CHEMISTRY OF RED OAK AND HONEYLOCUST SEEDLINGS.
Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5C.
W91-06964

RESOURCE QUALITY AND TROPHIC RESPONSES TO SIMULATED THROUGHFALL: EFFECTS ON DECOMPOSITION AND NUTRIENT FLUX IN A NO-TILLAGE AGROECOSYSTEM.
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 3F.
W91-06967

EFFECT OF PHOSPHORUS ON DROUGHT TOLERANCE IN CHLORIS GAYANA KUNTH AND COIX LACRYMA-JOBI L.
Hiroshima Univ. (Japan). Faculty of Applied Biological Science.
For primary bibliographic entry see Field 3F.
W91-06974

2J. Erosion and Sedimentation

INFLUENCE OF SEDIMENT AND GROUNDWATER ON THE DISTRIBUTION AND BIOMASS OF MYRIOPHYLLUM SPICATUM L. IN DEVIL'S LAKE, WISCONSIN.
Wisconsin Dept. of Natural Resources, Madison. Water Resources Research Section.
For primary bibliographic entry see Field 2H.
W91-06012

IMPORTANCE OF EMERGENT VEGETATION IN REDUCING SEDIMENT RESUSPENSION IN WETLANDS.
South Dakota State Univ., Brookings. Dept. of Wildlife and Fisheries.
For primary bibliographic entry see Field 2H.
W91-06017

HYDRODYNAMIC AND FLUVIAL MORPHOLOGIC PROCESSES: IMPLICATIONS FOR FISHERIES MANAGEMENT AND RESEARCH.
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
For primary bibliographic entry see Field 2E.
W91-06026

STUDY OF MIXING RATES AND SEDIMENTATION RATES IN MEIZHOU BAY SEDIMENTS.
Academia Sinica, Guangzhou (China). South China Sea Inst. of Oceanology.
For primary bibliographic entry see Field 2L.
W91-06101

USLE P FACTORS FOR SUBSURFACE DRAINAGE ON LOW SLOPES IN A HOT, HUMID CLIMATE.
Louisiana State Univ., Baton Rouge. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W91-06117

NEUTRON ACTIVATION ANALYSIS (NAA) AND GEOCHEMICAL STUDIES OF 38 ELEMENTS IN SURFACE SEDIMENTS FROM LOWER REACH AND ESTUARY OF HUANGHE (YELLOW) RIVER.
Academia Sinica, Qingdao (China). Inst. of Oceanology.
L. Peiquan, C. A. Huh, Z. Zhang, W. Tian, and L. Guanshan.
Acta Oceanologica Sinica, Vol. 9, No. 2, p 227-246, 1990. 14 fig, 3 tab, 8 ref.

Descriptors: *China, *Estuarine sediments, *Geochemistry, *Metals, *Neutron activation analysis, *Sediment analysis, Aluminum, Arsenic, Barium, Cesium, Chemical properties, Chromium, Cobalt, Correlation analysis, Hafnium, Huang He River, Iron, Manganese, Rare earth elements, Rubidium, Scandium, Tantalum, Titanium, Uranium, Vanadium, Zinc, Zirconium.

Huanghe River, the second largest river in China, starts from the Kalabayan Mountain Range and, after passing through nine provinces, ends at the coast of Shandong Peninsula. The massive load of suspended material carried by Huanghe is derived largely from erosion of the Huangtoo (loess) Plateau. Using a neutron activation analysis technique, 38 elements in sediments from the lower reach and estuary of Huanghe were determined. From interelemental correlations, it was found that a large number of metals (Mn, As, Co, Cr, Cs, Rb, Sc, Ti, Ta, V and Zn) correlated positively with Fe. Ba and Ca correlated positively with Al. Although some elements (Ti and lanthanides) showed no correlation with either Fe or Al. On the other hand, Hf and Zr showed a negative correlation with Fe. Elements that tended to be scavenged by Fe and Al colloids or suspended particles were enriched in sediments at the Huanghe Estuary relative to its lower reach. The contents of some elements (Zr, Hf, U, Ba) were higher in sediments from the lower reach of Huanghe than in the estuarine sediments, which may be related to the sorting during deposition of source materials. On the basis of their chemical properties and geochemical behavior, the 38 elements were classified into seven groups: (1) weathering-prone elements, group A--K, Rb, Cs and Na; (2) weathering-prone elements, group B--Mg, Ca, Ba and Al; (3) transition elements--Fe, Co, Ni, Zn, As, Sb, Mn, Cr, W, Mo, V, Ta, and Sc; (4) rare elements--group A (Zr and Hf) and group B (Ti); (5) rare earth elements--the lanthanides; (6) halogens--Cl and Br, and (7) natural radioactive elements--U and Th. (Mertz-PTT)
W91-06219

DYNAMICS OF DECLINING SOIL EROSION RATES.
Connecticut Univ., Storrs. Dept. of Agricultural and Resource Economics.
L. K. Lee.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 622-624, November/December 1990. 1 fig, 3 tab, 6 ref.

Descriptors: *Erosion, *Erosion rates, *Rill erosion, *Sheet erosion, *Soil erosion, Arable soils, Erosion control, National Resources Inventory, Soil Conservation Service, Soil surveys.

Data released from the 1987 National Resources Inventory, conducted by the Soil Conservation Service, estimate that average annual sheet and rill erosion on U.S cropland declined from 4.3 tons per acre per year in 1982 to 3.8 tons per acre per year in 1987. Although wind erosion rates rose during this same time period, declines in sheet and rill erosion occurred in every region of the country. Regionally, the declines were most significant in the Corn Belt, which contains about 22% of the nation's cropland. The Southern Plains, Mountain, and Northeast regions showed little or no declines in sheet and rill erosion. These regions, however, had sheet and rill erosion rates that in 1982 were already below the estimated national rate. Possible explanations for this reduction in soil loss include adoption and improvements in conservation practices, temporary diversions of cropland to federal land-idling programs during the 1982-1987 period, and conversion of erodible cropland to noncropland uses. The 1987 National Resources Inventory is designed to allow analysis of changes in land use and land use conditions during the five-year period from 1982 to 1987. (Mertz-PTT)
W91-06231

INDOOR SOIL EROSION RESEARCH FACILITY.
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
B. N. Wilson, and C. T . Rice.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 645-648, November/December 1990. 4 fig, 22 ref.

Descriptors: *Erosion, *Erosion rates, *Laboratory methods, *Rill erosion, *Soil erosion, Data collections, Experimental data, Laboratory equipment, Surface flow, Surface water.

A large-scale experimental apparatus for conducting erosion studies in a controlled laboratory setting was designed to study erosion processes on a 2.4 m by 9.8 m or smaller surface by rainfall and/or runoff forces. A computer room and wet laboratory were located adjacent to the space. Soil for the plot was stored outside. Suspended above the erosion surface was a rainfall simulator. Image-processing techniques were used to measure erosion characteristics. Surface velocities were determined by placing small wooden beads on the water surface. These beads then floated under a downstream video camera where images were recorded on video tape. The velocity was obtained by measuring the travel distance of beads with time. The facility was used to study the dynamic changes in rill characteristics and to evaluate the drainage network of rill. This system was unique in its capabilities of gathering detailed and accurate erosion data on a large, indoor surface. These studies illustrate the usefulness of the indoor facility for conducting experiments requiring sophisticated instrumentation techniques, better control of erosion parameters, and effective use of financial resources. (Mertz-PTT)
W91-06232

CROPPING AND TILLAGE OPTIONS TO ACHIEVE EROSION CONTROL GOALS AND MAXIMUM PROFIT ON IRREGULAR SLOPES.
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
A. J. Jones, R. A. Selley, and L. N. Mielke.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 648-653, November/December 1990. 3 fig, 7 tab, 12 ref.

Descriptors: *Erosion, *Erosion control, *Slope protection, *Soil erosion, Agricultural practices, Conservation, Environmental policy, Farm management, Food Security Act, Nebraska, Slope degradation, Slopes.

The conservation compliance provision of the 1985 Food Security Act was intended to reduce soil erosion to an acceptable level on highly erodible land and in such a manner that farmers participating in the program did not incur undue economic hardship. These goals were addressed by determining cropping and tillage options required to achieve maximum profit for several specific soil erosion control goals and by identifying the extent to which production inputs could be changed to minimize the loss of potential profit consistent with soil erosion control. A case study on a landscape from eastern Nebraska was used to convey the analytical approach used in the analysis. Irregular slope segments consisting of six landscape positions were considered when estimating soil loss using the universal soil loss equation. Upper and lower linear positions had the greatest erosion rates and the lowest gross margins of profit. Maximum gross margin was achieved in the field by planting continuous sorghum on the upper and lower interfluvial positions and a sorghum-soybean rotation on the shoulder, upper and lower linear, and foot slope positions. Erosion control was increased by changing from conventional tillage to reduced and no-till systems and by farming on the contour. Erosion was reduced further by substituting continuous sorghum and/or alfalfa for the sorghum-soybean rotation. Tradeoffs between profit and erosion control for combinations of tillage and cropping options were quantified. When erosion control objectives reduced potential profit below an desirable level, alternatives for reducing input costs were provided so that profit could be sustained. It is expected that this type of synthesis would lead to an integrated farming approach that includes goals for erosion control that are compatible with economic survival. (Author's abstract)
W91-06233

EFFECTS OF PAST EROSION ON THE INTERRILL ERODIBILITY OF A FRAGIPAN SOIL.
Agricultural Research Service, Oxford, MS.
F. E. Rhoton, L. D. Meyer, and D. D. Tyler.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 660-663, November/December 1990. 1 fig, 5 tab, 10 ref.

Descriptors: *Erosion, *Erosion rates, *Soil erosion, *Surface runoff, Agricultural runoff, Runoff, Runoff rates, Sedimentation, Silty soils, Storm runoff.

Soil susceptibility to erosion by water is subject to change as the thickness of well-developed profiles decreases and underlying horizons contribute increasing amounts of materials to the plow layer. Most soil erosion models do not account for these potential changes. How soil loss parameters change as a soil profile is progressively eroded away was studied on field sites located on a Grenada silt loam (fine silty, mixed, thermic, Glossic Fragiudalf) that represented virgin (uneroded), slightly eroded, moderately eroded, and severely eroded phases of the soil. Soil thicknesses above the fragipan were 100 cm for uneroded soil, 59 cm for slightly eroded, 42 cm for moderately eroded, and 19 cm for severely eroded soil. Simulated rainfall was applied to tilled plots at each site using an intensity of 7.3 cm/hour for the initial dry run. The following day, multiple-intensity rainfall was applied to the plots wetted by the previous storm. Sediment in the runoff from row sideslopes for all storms totaled 80.3 mg/hectare for slightly eroded sites, 71.4 mg/hectare for moderately eroded, and 58.6 mg/hectare for severely eroded sites; whereas the virgin site yielded only 30.9 mg/hectare. Runoff from these same sites totaled 1028 mg/hectare for virgin sites, 1067 mg/hectare for slightly eroded, 1090 mg/hectare for moderately eroded, and 1144 mg/hectare for severely eroded sites. Sediment size distributions at the virgin site were much coarser than those at the eroded sites, but the distributions among eroded sites generally were similar. The gradual decline in soil loss rates from eroded fragipan soils as profile thickness decreased illustrates the need for more thorough soil profile characterization and laboratory studies that relate soil properties to erodibility. (Author's abstract)
W91-06234

MANAGEMENT OF COASTAL ZONE EROSION IN NIGERIA.
Port Harcourt Univ. (Nigeria). Dept. of Geography.
C. U. Oyegun.
Ocean & Shoreline Management OSMAE6, Vol. 14, No. 3, p 215-228, 1990. 3 fig, 2 tab, 25 ref.

Descriptors: *Coastal zone management, *Coasts, *Erosion, *Erosion control, *Nigeria, Beach erosion, Coastal environment, Environmental protection, Geomorphology, Natural resources management, Political aspects.

There is, as yet, no universal agreement among coastal geomorphologists regarding the exact definition or delimitation of the coastal zone even though all recognize the existence of such a zone. The coastal zone is generally understood to extend from the low water mark to the furthest limits inland of marine influence. The limit for the Nigerian coast has been put at between 30-40 km from the coastline. This width is reduced along the barrier ridge-lagoon complex of the Lagos area and the strand coast in southeast Nigeria. Coastal zone erosion is manifested in Nigeria along the outer barrier beaches and the banks of tidal basins and creeks. The nature of shore erosion was examined by using case studies to highlight its causes, consequences and the implication for coastal resource management. The analysis is based on primary and secondary data sources. The global cause of accelerated coastal erosion has been attributed to rising sea-level, though local factors have exacerbated this process. Although the federal government of Nigeria is doing all it can to mitigate the problem, there remains the need to adopt more far-reaching strategies than the present ad hoc approach. A merger of all government parastatals charged with different aspects of the environment into an environmental authority staffed with goal-seeking scientists in needed. The conclusion is that rudiments of cost-benefit analysis should be used in deciding which coastal stretches require protection against erosion. (Mertz-PTT)
W91-06267

TRANSPORTED MATERIAL IN A SMALL RIVER WITH MULTIPLE IMPOUNDMENTS.
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
R. Palmer, and J. O'Keeffe.
Freshwater Biology FWBLAB, Vol. 24, No. 3, p 563-575, December 1990. 6 fig, 5 tab, 53 ref.

Descriptors: *Particulate matter, *Path of pollutants, *Reservoirs, *River sediments, *Rivers, *Sediment transport, Algal blooms, Buffalo River, Dam effects, Dissolved solids, Particle size, South Africa, Water pollution.

The transport of particulate material in a multiply-impounded southern African river (Buffalo River, South Africa) was studied from source to mouth over a period of 2 years during base flow conditions. More than 95% of the dissolved and particulate material in transport was ultra-fine (<80 microm). The ratio of coarse particles (1000-4000 microm) to fine particles (250-1000 microm) in transport decreased with increasing stream order as a result of inputs of fine particles from pollution sources and from plankton blooms discharged from reservoirs. The downstream effects of impoundment depended largely on the type of release and the quality of the inflowing water: surface-releasing reservoirs in the clean, upper reaches of the river had the least effect on transported material. A polluted surface-releasing impoundment in the mid-reaches of the river converted the particle size spectrum from ultra-fine to fine. Bottom-released water carried high concentrations (36-190 g/cu m) of small (<5 microm) and largely inorganic (86-93%) material. The distance required for zooplankton densities to reduce by 95% was between 4 and 8 km downstream of an impoundment, except below a polluted impoundment where 32-35 km was the required distance. Most of the downstream changes in transported organic matter in the Buffalo River are due to inflows of agricultural and urban effluent. These disturbances to the river cause greater perturbations than do the impoundments. (Author's abstract)
W91-06272

SEDIMENTARY GEOLOGY OF THE COLUMBIA RIVER ESTUARY.
Battelle/Marine Sciences Lab., Sequim, WA.
For primary bibliographic entry see Field 2L.
W91-06280

ENERGETICS AND SEDIMENTARY PROCESSES IN THE COLUMBIA RIVER ESTUARY.
Washington Univ., Seattle. Geophysics Program.
For primary bibliographic entry see Field 2L.
W91-06283

SELECTIVE SORTING AND ABRASION OF RIVER GRAVEL: I. THEORY.
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
G. Parker.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 131-149, February 1991. 7 fig, 23 ref.

Descriptors: *Abrasion, *Alluvial channels, *Bed load, *Gravel, *Particle size, *Sediment sorting, *Sediment transport, *Sedimentology, River basins, Rock properties, Sediment grading, Tectonics.

Most gravel rivers show a tendency for characteristic grain size to decrease in the downstream direction over scales of tens or hundreds of kilometers. It has been surmised that this downstream fining is due to some combination of selective sorting, by which finer grains are preferentially transported downstream; and abrasion, by which individual particles are reduced in size. A framework for the simultaneous treatment of both phenomena has been developed. The analysis is restricted to bed-load transport of gravel. Only abrasion due to binary collisions between moving bed load and stationary bed particles is considered. The formulation includes the possibility of differential basin uplift and subsidence due to tectonism, and

mixtures of rock types with differing coefficients of abrasion. The formulation of selective sorting is based on the concept of hiding, as applied to a surface-based bed-load transport relation. Abrasion is first treated in terms of a Lagrangian formulation for individual grains, and then transformed into an Eulerian expression that appears in the formulation of gravel mass balance. (See also W91-06291) (Author's abstract)
W91-06290

SELECTIVE SORTING AND ABRASION OF RIVER GRAVEL: II. APPLICATIONS.
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 2E.
W91-06291

VORTEX-SETTLING BASIN DESIGN CONSIDERATIONS.
Irrigation and Power Research Inst., Amritsar (India).
For primary bibliographic entry see Field 8B.
W91-06292

SUSPENDED SEDIMENT-TRANSPORT CAPACITY FOR OPEN CHANNEL FLOW.
West Virginia Univ., Morgantown. Dept. of Mechanical and Aerospace Engineering.
I. Celik, and W. Rodi.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 191-204, February 1991. 3 fig, 2 tab, 29 ref.

Descriptors: *Correlation analysis, *Open-channel flow, *Sediment transport, *Suspended load, *Suspended sediments, Bed load, Flow equations, Open channels.

The suspended sediment-transport capacity of open channel flow can be calculated by a fairly simple correlation. The correlation is based on the assumption that the work performed by buoyancy force on the sediment particles is proportional to the production of turbulent kinetic energy. The proportionality constant is determined by calibration using a wide range of experimental data. The new formula does involve bed-load correlations, and, hence, avoids the considerable uncertainty generic to those correlations. By assuming a suitable concentration profile, the formula can be used for calculating the maximum, full-capacity concentration at a reference level, but the formula itself does not involve a priori profile assumptions. An approximate relation is provided between the depth-averaged concentration and the transport concentration itself. This makes it possible to calculate easily the reference bed concentrations using a graphical chart provided for the cases where the Rouse profile for concentration is a good approximation. (Author's abstract)
W91-06293

DEPOSITIONAL RECORD OF A GLACIAL-LAKE OUTBURST: GLACIAL LAKE SOURIS, NORTH DAKOTA.
National Highway Traffic Safety Administration, East Liberty, OH. Vehicle Research and Test Center.
M. L. Lord.
Geological Society of America Bulletin BUGMAF, Vol. 103, No. 2, p 290-299, February 1991. 13 fig, 1 tab, 41 ref.

Descriptors: *Glacial sediments, *Lake sediments, *North Dakota, *Sediment distribution, *Sediment transport, *Sedimentation, *Turbidity currents, Aggradation, Braided streams, Deposition, Geologic history, Glacial drift, Gravel, Sand.

Glacial Lake Souris, in what is now North Dakota, was inundated by sediment-laden water from the outburst of Glacial Lake Regina (Saskatchewan). Glacial-lake outbursts were common during the Late Pleistocene, but detailed studies of outburst-deposited sediments in lake environments have not been done. The outburst-deposited sediments in Lake Souris have been grouped into three lithofacies on the basis of textural analyses: (1) sand, (2) matrix-rich gravel, and (3) matrix-deficient gravel. Sand is the most common sediment and generally overlies other lithofacies. Matrix-rich, lignite-bearing gravel generally occurs at the base of the outburst sections. Matrix-deficient gravel occurs near the ground surface, overlying other outburst lithofacies, in the inlet area. Deposition of the outburst sediment is attributed to three main processes: low-density turbidity current: (the predominant process), high-density turbidity currents, and aggradation in braided rivers. Continuous, low-density turbidity currents caused by the influx of sediment-laden flows and by residual currents from high-density flows characterized the outburst event in Lake Souris. Most high-density flows resulted from the initial influx of the outburst or from continuous avalanching as a result of rapid deposition. Thick, homogenous sections of outburst sediments; a gradual, systematic fining of sediments distally from the Souris spillway; and the scarcity of silt-sized and clay-sized sediment indicate that there was little decrease in flow energy during the outburst. Nonrepetitive vertical sequences, showing little textural variation, indicate that there was little migration of individual depositions. These characteristics may be used to identify and interpret other outburst events in similar settings and to help evaluate the Pleistocene sedimentary record in the marine offshore zone. (Author's abstract)
W91-06411

MORPHOLOGY AND DOWNSTREAM HYDRAULIC GEOMETRY RELATIONS OF ALLUVIAL STREAM CHANNELS IN A HUMID TROPICAL ENVIRONMENT, SOUTHWESTERN NIGERIA.
Ondo State Univ., Ado-Ekiti (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06485

METHOD FOR PREDICTING TERRAIN SUSCEPTIBLE TO LANDSLIDES FOLLOWING FOREST HARVESTING: A CASE STUDY FROM THE SOUTHERN COAST MOUNTAINS OF BRITISH COLUMBIA.
British Columbia Ministry of Environment, Victoria.
D. E. Howes.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 143-154, 5 fig, 2 tab, 21 ref.

Descriptors: *British Columbia, *Forest hydrology, *Landslides, *Soil water, *Terrain analysis, *Watershed management, Canada, Computerized maps, Geologic mapping, Land clearing, Land management, Logging, Rainfall-runoff relationships, Slope stability.

Several different types of terrain evaluations have been undertaken for the assessment of landslide hazards and include simple inventories of existing mass movements to multiple-factor mapping of slope, geology, soils, and other terrain features. A terrain evaluation method has been developed for predicting post-logging landslide activity based on the analysis of base data obtained from a landslide inventory and a terrain (surficial geology) mapping program. More objective and quantitative than previous approaches used in British Columbia, Canada, it involves four steps: (1) defining homogeneous areas, terrain polygons, with respect to their surficial geology; (2) analysis of landslide site data to identify factors influencing clearcut landslides; (3) defining a set of terrain classes based on these factors such that each polygon can be assigned to only one class; and (4) grouping the classes into four stability ratings based on the ratio of the number of clearcut landslides to the number of clearcut hectares. The application of this system to a case study allowed a computer-generated landslide rating map and a comparison of landslide rates to documented changes in local precipitation records since 1940. It was found that clearcut landslide rates for defined time periods corresponded closely to the historical precipitation trends. The difference between the natural and clearcut landslide rates during this period suggests that the removal of the forest cover has strongly influenced the clearcut landslide rate in this watershed by increasing soil moisture conditions and/or the reduction of root reinforcement, and has been further aggravated by increasing 'wetter' conditions during the past 28 years. (See also W91-06510) (Fish-PTT)
W91-06523

TEST OF AN ERODIBILITY RATING SYSTEM FOR THE FOOTHILLS OF CENTRAL ALBERTA, CANADA.
National Agrarian Univ., Lima (Peru). Dept. Manejo Forestal.
C. A. Llerena, H. Zhang, and R. L. Rothwell.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 155-161, 3 fig, 1 tab, 15 ref.

Descriptors: *Alberta, *Forest hydrology, *Forest soils, *Model studies, *Soil erosion, *Watershed management, Canada, Erosion rates, Forest watersheds, Hydrologic models, Infiltration rate, Rainfall infiltration, Soil stability, Soil water, Soil-water-plant relationships.

Forest harvesting disturbs mineral soil, increasing the potential for erosion and water quality deterioration. Several systems to predict or assess erosion hazard have been proposed and developed in the past. A proposed method of erosion hazard rating, based on infiltration rates of forest cover-soil associations as erodibility indicators, was assessed against measured soil loss using natural and artificial rainfall for an area in the Rocky Mountain foothills of west central Alberta. Erosion from plots was measured and ranked as low, moderate, or high. Both testing methods indicated similar rates of erosion for the forest cover-soil associations tested. Comparison of the erosion hazard-ranked areas to those ranked on measured erosion showed poor agreement. Statistical analyses of the measured erosion data indicated no significant differences in erodibility between and within the different forest cover types and soil associations. Based on these observations and results, it may be concluded that there is no consistent difference in erodibility among the soil associations and forest cover types tested, and that the proposed erosion hazard rating system is ineffective. However, the small differences in measured erosion, and high variability weaken these conclusions. A larger sample size and greater control of environmental variables may have provided a more conclusive test. The use of a single parameter such as infiltration rate, as a predictor of erosion hazard may be an unrealistic expectation. (See also W91-06510) (Fish-PTT)
W91-06524

PERFORMANCE OF GULLY EROSION CONTROL MEASURES IN SOUTHEASTERN NIGERIA.
Nigeria Univ., Nsukka. Dept. of Geology.
For primary bibliographic entry see Field 4D.
W91-06525

POSSIBLE HYDROLOGICAL AND GEOMORPHOLOGICAL CHANGES DUE TO ALTERATION OF FOREST.
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 4C.
W91-06526

EVALUATION OF THE EFFECT OF DEFORESTATION ON SLOPE STABILITY AND ITS APPLICATION TO WATERSHED MANAGEMENT.
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Forestry.
Y. Tsukamoto, and H. Minematsu.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 181-189, 5 fig, 2 tab, 6 ref.

Descriptors: *Deforestation, *Forest hydrology, *Forest soils, *Landslides, *Slope stability, *Watershed management, Model studies, Roots, Soil creep, Soil erosion, Soil stabilization, Soil strength, Theoretical analysis.

One of the largest hydrological events in a watershed with forested steep slopes is the occurrence of numerous debris slides in heavy storms, resulting in serious devastation of hillslopes, torrents, and downstream channels. The occurrence of debris slides is greatly affected by forest cutting. The effects of forest treatments on slope stability were examined analytically by making use of the concept of critical soil depths, zero order basins, and the upper bound theorem. The critical soil depth was estimated as an index of instability of surface soils. According to the upper bound analysis, a soil is assumed to behave as a perfectly plastic material; the strength of the soil is expressed by an undrained shear strength and the law of incompressibility is used. For the computation, a failure of surface soils is assumed to consist of three blocks. Major parameters affecting the stability of surface soils include: length of debris slide, width of debris slide, surface soil depth, depth of transitional layer, ratio of vertical root volume to total volume, soil cohesion, slope gradient, angle of a sliding plane to the slope surface, and weight of saturated soil. The safety factor was calculated on three types of surface soil conditions: soil without tree roots, soil with vertical roots, and soil with vertical and lateral roots. It was found that tree roots reinforce soil strength remarkably; deforestation greatly reduces the safety factors; and the greatest strength was indicated in mature forests where the surface soil depth was less than 100 cm. (See also W91-06510) (Fish-PTT)
W91-06527

RECOVERY OF A NEW MEXICO DRAINAGE BASIN FROM A FOREST FIRE.
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W91-06528

INFILTRATION AND REDISTRIBUTION OF OVERLAND FLOW AND SEDIMENT ON A LOW RELIEF LANDSCAPE OF SEMI-ARID, TROPICAL QUEENSLAND.
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06529

EFFECT OF DIFFERENT TYPES OF FOREST MANAGEMENT ON THE TRANSFORMATION OF RAINFALL ENERGY BY THE CANOPY IN RELATION TO SOIL EROSION.
Silsoe Coll. (England). Dept. of Field Engineering.
For primary bibliographic entry see Field 4A.
W91-06530

STUDIES ON THE HYDROLOGICAL PROCESSES IN THE FOREST DRAINAGE BASINS OF THE WESTERN GHATS OF INDIA.
Centre for Water Resources Development and Management, Calicut (India).
For primary bibliographic entry see Field 4A.
W91-06531

AMOUNT OF RUNOFF AND SOIL LOSSES FROM VARIOUS LAND-USE SAMPLING PLOTS IN SAKOLNAKORN PROVINCE, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Chee Watershed Research Station.
For primary bibliographic entry see Field 4A.
W91-06532

DEFORESTATION AND EROSION IN THE NEPALESE HIMALAYA--IS THE LINK MYTH OR REALITY.
Land Capability Consultants Ltd., Cambridge (England).
For primary bibliographic entry see Field 4C.
W91-06533

REFORESTATION: ON-SITE EFFECTS ON HYDROLOGY AND EROSION, EASTERN RAUKUMARA RANGE, NEW ZEALAND.
Forest Research Inst., Christchurch (New Zealand). Forest and Wildland Ecosystems Div.
For primary bibliographic entry see Field 4A.
W91-06556

SIMULATION OF WATER FLOW AND SOIL EROSION PROCESSES WITH A DISTRIBUTED PHYSICALLY-BASED MODELLING SYSTEM.
Danish Inst. of Applied Hydraulics, Hoersholm.
B. Storm, G. H. Jorgensen, and M. Styczen.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 595-608, 7 fig, 17 ref.

Descriptors: *Deforestation, *Forest hydrology, *Hydrologic models, *Model studies, *Runoff forecasting, *Soil erosion, Hydrograph analysis, Iowa, Land management, Overland flow, Sediment discharge, Sediment transport, Sediment yield, Thailand.

Catchments in many geographical areas have been subject to extensive land-use changes during the recent decades. Large-scale deforestation has caused increasing concern regarding the subsequent impact on the hydrological regime and the increased risk of severe soil erosion. The development of mathematical models has been directed towards distributed and physically-based models which reliably describe both the hydrological processes and the erosion and transport processes within the catchment. A new soil erosion model (SEM) has been developed based on a physical description of the involved processes. The SEM model includes the processes of splash detachment of soil by overland flow, overland flow detachment and net transport, and net erosion/deposition within each model grid square. SEM has been incorporated as a separate component in the physically-based, distributed hydrological modeling system SHE. The SEM/SHE model complex was tested on a small research catchment with an area of 5.6 ha in the U.S. (Iowa), and showed good agreement between simulated and observed hydrographs and sediment yield. Application to two upland catchments in Thailand of 45 sq km and 128 sq km show that, despite constraints on the spatial representation of meteorological input and soil data, the hydrological regime is adequately simulated. The simulated sediment discharge was compared with computed values based on a sediment rating curve. Recognizing the uncertainty on these values, the comparisons show reasonable agreement. Displays of spatial and temporal varying quantities such as the phreatic surface level and net erosion/disposition illustrates one of the strengths in the SEM/SHE. (See also W91-06510) (Fish-PTT)
W91-06567

EROSION AND SEDIMENTATION IN THE PACIFIC RIM.
Oregon State Univ., Corvallis. Coll. of Forestry.
Proceedings of an International Symposium held at Oregon State University, Corvallis, Oregon, August 3-7, 1987. International Association of Hydrological Sciences, Washington, DC. 1987. 510 p.

Descriptors: *Erosion, *Land use, *Pacific Rim, *Sedimentation, Climates, Conferences, Dam construction, Disasters, Erosion control, Prediction, Rainfall, Resources management, Symposium.

The 1987 International Symposium on Erosion and Sedimentation in the Pacific Rim concentrates on a landscape characterized by high relief and locally heavy rainfall. Conditions lead to frequent natural disasters, accentuated, in some cases, by land use practices. Despite the physical instability of many of the landscapes, they support and provide a variety of valuable resources, such as fish, forests, wildlife, minerals and agricultural products. Human concerns and responses to the instability of landscapes differ greatly with cultural and social settings. At one extreme, the Japanese have developed elaborate research, educational, industrial, and governmental programs for erosion control practices in their highly industrialized, densely populated archipelago. Erosion control projects emphasize hard methodologies, such as the sabo dams, as well as technologically advanced predictive techniques. At the other extreme, third world countries such as Columbia are just beginning to identify their hydrologic and sedimentation hazard areas. People living in close association with natural hazards develop technical and social mechanisms to cope with periodic disasters. This symposium was structured around four special sessions: geomorphic and hydrologic dynamics of zero-order basins; the physics, triggering mechanisms, and runout characteristics of debris flows; sediment transport and channel morphology in high-gradient mountain streams, and drainage basin response to natural and human-induced disturbances including intensive land use, gravel mining, and damming. (See W91-06571 thru W91-06654) (Brunone-PTT)
W91-06570

EROSION AND SEDIMENTATION ISSUES IN PERU.
National Agrarian Univ., Lima (Peru). Dept. Manejo Forestal.
C. A. Llerena.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 3-14. 1 fig, 63 ref.

Descriptors: *Erosion, *Erosion control, *Forestry, *Peru, *Sedimentation, Climates, Gully erosion, Land management, Landslides, Mass wasting, Rill erosion, Terracing.

Erosion and sedimentation are common problems in Peru's coastal, highland, high jungle, and low jungle regions. The highlands and high jungle are the regions with the most serious problems due to their physiographic, climatic, and socio-economic characteristics. These regions have problems with rill, gully, and mass erosion. Promising solutions are based on local traditional technology: terracing in the highlands, and agroforestry in the jungle. Teamwork between Peruvian and foreign institutions keeps research and extension projects going. Some specific areas needing new research projects are management of steep lands, landslide research, and erosion and sedimentation processes in jungle watersheds. (See also W91-06570) (Author's abstract)
W91-06571

EROSION RESEARCH AND CONTROL IN JAPAN.
Kyoto Univ. (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 4D.
W91-06572

OVERVIEW: 'ZERO-ORDER BASINS' AND PROBLEMS OF DRAINAGE DENSITY, SEDIMENT TRANSPORT AND HILLSLOPE MORPHOLOGY.
California Univ., Berkeley. Dept. of Geology and Geophysics.
W. E. Dietrich, S. L. Reneau, and C. J. Reneau.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 27-37. 4 fig, 25 ref. NSF Grants EAR-8416775 and EAR-8451175.

Descriptors: *Drainage density, *Geomorphology, *Sediment transport, *Slopes, Channels, Dating, Diffusion coefficient, Groundwater movement, Heterogeneity, Hollows, Model studies, Slope profile.

Soil-mantled hillslopes are divided into a network of hollows. Analogous to channel networks, hollows can be assigned to a magnitude based on the number of unbranched tributary hollows they have. The spacing between the smallest, magnitude

one, hollows may be determined in part by the minimum size required for a thickened colluvial deposit to overcome lateral root strength resistance. The source area size above channel heads varies inversely with the hollow gradient, except where groundwater flow is strongly forced to the surface by bedrock inhomogeneities. Deposits in hollows record long periods of erosion from side slopes and noses, and dating of these deposits provides a means to estimate local sediment transport rates. Surveys of nose to hollow slope profiles may allow estimation of the diffusion coefficient in a slope dependent transport equation. Hollows appear to possess a characteristic three-dimensional geometry, whose properties are not well-established. (See also W91-06570) (Author's abstract)
W91-06573

SIZE AND LOCATION OF COLLUVIAL LANDSLIDES IN A STEEP FORESTED LANDSCAPE.
California Univ., Berkeley. Dept. of Geology and Geophysics.
S. L. Reneau, and W. E. Dietrich.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 39-48. 4 fig, 1 tab, 22 ref. NSF Grants EAR-8416775 and EAR-8451175.

Descriptors: *California, *Colluvial soils, *Erosion, *Landslides, *Slope stability, *Soil erosion, Forest watersheds, Groundwater movement, Hollows, Mountain watersheds, Pore pressure, Soil properties, Soil texture, Soil water, Vegetation.

An inventory of 61 landslide scars in part of the San Pedro Ridge in the central California Coast Ranges was used to document sites of instability and to infer conditions necessary for failure. Scar dimensions cluster around widths of 7 to 10 m, lengths of 10 to 20 m, and depths of 0.7 to 1.1 m. Simple theoretical analyses indicate that root strength along the margins of a potential landslide imposes constraints on landslide size; typical scar size may reflect the size of a deposit required for instability at sites with typical vegetation, slope gradients, soil texture, and hydrology. Hollows are the main source of landslides, consistent with the convergence of shallow groundwater flow and the long-term accumulation of colluvium in hollows, but conditions of sufficiently thick soil and high pore pressure for failure are also attained on side slopes. Development of deposits much larger than required for failure may indicate unusual site conditions that promote stability; eventual failure can produce exceptionally large debris flows. (See also W91-06570) (Brunone-PTT)
W91-06574

CONTRIBUTION OF BEDROCK GROUNDWATER FLOW TO STORM RUNOFF AND HIGH PORE PRESSURE DEVELOPMENT IN HOLLOWS.
California Univ., Berkeley. Dept. of Geology and Geophysics.
C. J. Wilson, and W. E. Dietrich.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 49-59. 6 fig, 23 ref. NSF Grant EAR-8416775.

Descriptors: *California, *Erosion, *Hollows, *Pore pressure, *Slope stability, *Soil water, *Storm runoff, *Surface-groundwater relations, Channel erosion, Colluvial soils, Groundwater movement, Landslides, Overland flow, Permeability, Precipitation, Slopes, Water table.

Many analyses of runoff generation, pore pressure development, and slope stability in colluvium-mantled hollows assume that the bedrock-colluvium boundary forms a major hydrologic barrier during periods of intense precipitation. Detailed field observations are presented for one year of intensive monitoring at a 16,000 sq m grassland basin in Mt. Tamalpais State Park, Marin County, California. These data demonstrate that significant large-scale and small-scale interactions between storm flow in the bedrock and the colluvium occur at this site. The basin-scale, topographically driven, flow system terminates at the channel head, where a low-permeability block of bedrock forces groundwater to the surface with an average exfiltration gradient of 0.5 m/m and excess pressure head of 1 m within the basal colluvium. This low-permeability block also forces the water table to remain close to the ground surface along the hollow axes, enabling several storms per year to generate significant saturation overland flow. Surface erosion by saturation overland flow may be the dominant process causing channel incision in the relatively low-gradient hollow. Local bedrock permeability heterogeneities cause fluctuations in the position of the bedrock water table and result in unexpected midslope high pore pressures and a persistent discontinuous zone of saturation overland flow. Presently, exfiltration along the hollow prevents buildup of pore pressures in the bedrock and colluvium sufficient to cause landsliding, but on steep hillslopes local upwelling of bedrock storm flow may strongly influence soil instability. (See also W91-06570) (Author's abstract)
W91-06575

HYDROGEOMORPHOLOGICAL CHARACTERISTICS OF A ZERO-ORDER BASIN.
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Forestry.
For primary bibliographic entry see Field 2E.
W91-06576

SUBSURFACE PIPEFLOW DYNAMICS OF NORTH-COASTAL CALIFORNIA SWALE SYSTEMS.
Forest Service, Arcadia, CA.
R. R. Ziemer, and J. S. Albright.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 71-80. 4 fig, 1 tab, 13 ref.

Descriptors: *California, *Erosion, *Geomorphology, *Groundwater movement, *Pipe flow, *Piping, *Soil erosion, *Swales, Calibrations, Channel flow, Channels, Discharge rates, Gullies, Headwaters, Instrumentation, Precipitation.

Under suitable conditions, subsurface drainage can promote accelerated erosion by chemical, physiochemical, and physical (piping and landsliding) processes. Pipeflow dynamics were investigated at Caspar Creek Experimental Watershed in north-coastal California, near Ft. Bragg. Pipes have been observed at depths to 2 m within trenched swales and at the heads of gullied channels in small (0.8 to 2 ha) headwater drainages. Digital data loggers connected to pressure transducers monitor discharge using calibrated standpipes. During storms, pipeflow up to 8 L/sec has been measured, while, within the same swales, no surface channel flow occurred. Pipeflow discharge has been correlated with antecedent precipitation. (See also W91-06570) (Author's abstract)
W91-06577

BEDROCK GEOMETRY OF UNCHANNELIZED VALLEYS.
Humboldt State Univ., Arcata, CA. Dept. of Geology.
L. Dengler, A. K. Lehre, and C. J. Wilson.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 81-90. 8 fig, 2 tab, 22 ref.

Descriptors: *Bedrock, *California, *Colluvial soils, *Erosion, *Geologic formations, *Geomorphology, *Sediments, *Valleys, Boreholes, Hollows, Seismic exploration, Stratigraphy, Subsurface flow.

The gradual infilling and rapid evacuation of colluvium into and out of unchannelized valleys (hollows) are important processes in molding hillslopes and controlling sediment budgets. Models of subsurface flow within these hollows have shown the importance of bedrock geometry on pore pressure and subsurface runoff but bedrock geometry is known in detail in very few hollows. Seismic refraction was used to determine bedrock geometry of unchannelized valleys in the Marin headlands of California. An isopach map of colluvium thickness and a contour map of bedrock velocities were constructed from seismic lines run down the axes of hollows, transverse to the axes, and along valley walls and interfluves. The bedrock surface is smooth and conforms fairly closely to the surface topography. Colluvium is thickest in the axes, with greatest depths near the top of one swale and in the middle portion of another. The gentlest swale is at least as thick as the most deeply incised, and small bedrock tributary hollows are developed beneath relatively flat ground surfaces. Bedrock velocities are highest in the axes and increase downslope. The valley walls and interfluves have conspicuously low bedrock velocities. This velocity pattern may be due to bedrock fracturing, the position of the water level and thickness of saprolite. (See also W91-06570) (Brunone-PTT)
W91-06578

RATES OF SOIL CREEP ON COLLUVIUM-MANTLED HILLSLOPES IN NORTH-CENTRAL CALIFORNIA.
Humboldt State Univ., Arcata, CA. Dept. of Geology.
A. K. Lehre.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 91-100. 4 fig, 2 tab, 9 ref.

Descriptors: *California, *Colluvial soils, *Creep, *Erosion, *Mass wasting, *Slope stability, *Soil creep, *Soil erosion, *Soil properties, Detritus, Field studies, Model studies, Seasonal variation.

In 1972, 102 soil creep measurement pillars were installed on hillslopes in the drainage basin of Lone Tree Creek, a small, relatively undisturbed drainage basin 14 km northwest of San Francisco. Two pillars were excavated in 1974 and ten more in 1984. In many pillars little or no difference between segments was detected. Mean volume flux over this twelve year period was very small: between about 0.8 cc/cm/yr (best estimate) and 2.6 cc/cm/yr (mean upper bound). This result constrains rates of soil creep (averaged over depths of 0.4 to 0.6 m) to 0.4 to 1.2 mm/yr. Creep rates were unrelated to slope position or steepness. Evidence from pillars and field observations suggests that biogenic creep caused by burrowing animals (chiefly voles and gophers) may account for most of the present-day soil creep of grass-covered colluvium. Many hillslopes are heavily covered by burrow debris, while >75% of the pillars excavated had been disturbed by burrowing. Simple calculations based on the volume of debris piles and excavated tunnels yield rates of biogenic creep that are locally on the order of 10 cc/cm/yr or more, implying that biogenic creep is significantly more important than 'inorganic' seasonal creep. (See also W91-06570) (Author's abstract)
W91-06579

DYNAMIC MODEL OF SLOPE STABILITY IN ZERO-ORDER BASINS.
Forest Service, Logan, UT. Intermountain Research Station.
R. C. Sidle.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 100-110. 3 fig, 29 ref.

Descriptors: *Erosion, *Geomorphology, *Landslides, *Mass wasting, *Mathematical models, *Model studies, *Slope stability, *Zero-order basins, Channel accretion, Feedback mechanisms, Precipitation, Rainfall, Root development, Saturated soils, Slope degradation, Snowmelt.

Zero-order basins are prone to soil mass movements because of their tendency to accumulate groundwater during extreme rainfall and snowmelt events. Once soil in a slope depression has failed, positive feedback mechanisms are initiated to ensure the eventual repetition of mass movement. The frequency of repetitive failure is governed by

rates of infilling, changes in soil strength, and the probability of a triggering rainfall (or snowmelt) during a given year. A conceptual model, based on infinite-slope analyses, was developed to evaluate the probability of failure in a zero-order basin over time. Deterministic functions were developed for soil accretion, root strength regrowth, and vegetation surcharge increase starting at the time of failure. The degree of soil saturation required to initiate slope failure (M) was then calculated for each year after initial failure. Values of M were related to stochastic precipitation variables, and the probability of a failure occurring in any given year was calculated. (See also W91-06570) (Author's abstract)
W91-06580

ZERO-ORDER BASINS SHAPED BY DEBRIS FLOWS, SUNOL, CALIFORNIA, USA.
Geological Survey, Menlo Park, CA. Branch of Geologic Risk Assessment.
C. S. Alger, and S. D. Ellen.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 111-119. 6 fig, 10 ref.

Descriptors: *California, *Debris flow, *Erosion, *Mass wasting, *Soil erosion, Channel erosion, Climates, History, Landslides, Slope degradation, Storms, Zero-order basins.

Open, non-channelized depressions on steep valley walls of incised streams near the active Calaveras fault are closely associated with recurrence of debris flows in a 6 sq km study area in the San Francisco Bay region, California. These zero-order basins, or bowls, occupy on only 26% of valley walls but include 74% of mapped debris-flow scars. Other data suggest that debris flows are responsible for the initiation and carving of the bowls. Estimates based on debris-flow scar volumes from an 11-year storm event show that debris-flow erosion can probably account for bowl development in a reasonable time period. Axial profiles of bowls are compatible with debris-flow-related slopes elsewhere in the Bay region and with the general mechanics of debris-flow initiation and flow. The continuum of bowl size and geometry, combined with relatively constant climatic history, suggests continuity of process into the past. (See also W91-06570) (Author's abstract)
W91-06581

TERRAIN ANALYSIS FOR QUANTITATIVE DESCRIPTION OF ZERO-ORDER BASINS.
Queen Mary Coll., London (England). Dept. of Geography and Earth Science.
C. R. Thorne, L. W. Zevenbergen, T. P. Burt, and D. P. Butcher.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 121-130. 4 fig, 8 ref. Natural Environment Research Council, UK, studentship GT4/AAPS/18 (D.P.B.).

Descriptors: *Computer models, *Geomorphology, *Model studies, *Terrain analysis, *Zero-order basins, Computer programs, Drainage area, Groundwater runoff, Sedimentation, Surface runoff.

Zero-order basins are topographic depressions at the head of fluvial systems. They are collecting areas for water and sediment, tending to concentrate both surface and subsurface runoff. Hydrological and sedimentary processes in zero-order basins have received much attention recently, but relatively little work has concerned the objective and quantitative characterization of basin geometry. A FORTRAN terrain analysis computer program was developed that can be applied to any zero-order basin for which a contour map is available. Output consists of line printer maps of seven topographic indices, including elevation, slope, aspect, profile curvature, planform curvature, drainage area, and upslope distance with the values stored in matrices and available for subsequent in semi-distributed models. The analysis is illustrated using data from Slapton Wood catchment, Devon, England. (See also W91-06570) (Brunone-PTT)
W91-06582

EXPERIMENTAL STUDY OF SLOPE FAILURE CAUSED BY HEAVY RAINFALL.
National Research Center for Disaster Prevention, Sakura (Japan).
T. Fukuzono.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 133-134. 3 fig, 3 ref.

Descriptors: *Erosion, *Geomorphology, *Model studies, *Rainfall, *Slope degradation, *Slope stability, Boundary layers, Equilibrium, Groundwater, Groundwater level, Physical models, Simulated rainfall, Soil properties, Soil types, Soil water.

Obtaining information needed to explain slope failure mechanisms is difficult, because the exact failure site, the time of failure, and soil conditions at failure are uncertain. In this study, conditions leading up to slope failure were examined using nearly actual-scale slope models. Soil parameters were monitored as the slope went from steady state to final failure. Each model slope had a ground surface parallel to the impervious bottom boundary and both sides were bounded by vertical steel walls. The soil layer was either loamy soil or sandy soil. The intensity of artificial rainfall was maintained at 15 and 20 mm/hr for loamy-soil slopes and at 50 mm/hr for sandy-soil slopes until large-scale slope failure occurred. Moisture content, groundwater level, earth pressure, slope-surface displacement and other parameters were continuously measured. All portions of the sandy soil were at equilibrium before and even after the first additions of rainfall. Critical portions of the soil layer then developed into sliding surfaces with additional rainfall. The velocity of surface displacement before final failure in the loamy soil increased in four successive stages: very little increase in velocity; uniform acceleration; uniform, high velocity; and exponential increase in velocity. For both loamy and sandy slopes, during the period of very rapid displacement, the velocity of surface displacement and acceleration of surface displacement were related. The resulting equation can be used to predict failure time of a slope. (See also W91-06570) (Brunone-PTT)
W91-06583

TOMBI LANDSLIDE AND ITS IMPACT ON THE JOGANJI RIVER, JAPAN.
Chuo Univ., Tokyo (Japan). Inst. of Geosciences.
S. Ouchi.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 135-136. 1 fig.

Descriptors: *Erosion, *Geomorphology, *Japan, *Joganji River, *Landslides, *Sediment transport, Alluvial fans, Dam effects, Deposition, Disasters, Earthquakes, Geological terraces, History, Mudflows, Reservoirs.

The dimensions of large landslides that occur in remote mountain areas are often very difficult to evaluate. The dimensions of the Tombi landslide, and its impact on a river, was reexamined using old documents and geomorphological and geological information. A strong earthquake triggered a large landslide on Mt. Tombi in April 1858 in the upstream area of the Joganji River, which flows down about 56 km into the Sea of Japan. The landslide debris dammed up mountain valleys to form large natural reservoirs. The natural dams then collapsed with increasing meltwater and a large volume of sediment flowed down in the form of a mud flow. The original landslide debris and terraces formed by the debris can be traced for about 12 km from the landslide scarp. The landslide debris is characterized by large blocks of crushed rock that indicate violent movement of the debris flow. The mean river bed height downstream from the alluvial fan apex to the river mouth shows the general tendency of accumulation until 1937. The tendency for deposition then switched to erosion. The Joganji River is apparently still recovering from the disturbance induced by the Tombi landslide. Occasional small-scale landslides and mud flows are still carrying the Tombi landslide debris down to the main valley, and frequent floods in the valleys are carrying these materials, mainly finer portions, further downstream. (See also W91-06570) (Brunone-PTT)
W91-06584

ONTAKE LANDSLIDE OF SEPTEMBER 14, 1984, IN JAPAN.
Public Works Research Inst., Tsukuba (Japan). Sabo Div.
Y. Hara, and A. Yazawa.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 137-138. 4 fig, 1 ref.

Descriptors: *Disasters, *Earthquakes, *Japan, *Landslides, *Ontake Landslide, Avalanches, Dam effects, Flow velocity, Friction coefficient, Wave height.

On September 14, 1984, a severe earthquake triggered a large-scale landslide and many other landslides, causing damage to public work facilities and killing people. The debris avalanche first flowed into the Denjo River, blocking the Ohtaki River above its confluence with the Nigorisawa River to form a landslide dam about 30 m high. In the upper reaches forming the Denjo and Nigorisawa Rivers, flow velocity apparently exceeded the velocity of a debris flow with a normal wave height and from Gakiganodo downstream the flow was rather slow. The Ontake landslide, like other landslides composed of volcaniclastic material, tends to have a low friction coefficient. (See also W91-06570) (Brunone-PTT)
W91-06585

INITIATION AND MECHANICS OF DEBRIS AVALANCHES ON STEEP FOREST SLOPES.
California Univ., Los Angeles. Dept. of Geography.
A. R. Orme.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 139-140. 1 fig.

Descriptors: *Avalanches, *Erosion, *Forest watersheds, *Geomorphology, *Landslides, *Slope degradation, *Slopes, Bedrock, Cohesion, Deposition, Hollows, Mass wasting, Precipitation, Rainfall, Root zone, Slope profile, Snowmelt, Soil texture.

Debris avalanches are a distinct type of mass movement commonly triggered by intense rainfall and melting snow on steep hillslopes underlain by poorly cohesive materials. They are triggered by a combination of factors which may be grouped in terms of the nature and magnitude of precipitation, slope profile characteristics, soil cohesion and infiltration capacity, bedrock attitude and upper surface characteristics, and subsurface morphology. Debris avalanches are most likely to develop where, as a result of intense and prolonged rainfall on melting snow, subsurface drainage converges on bedrock hollows filled with poorly cohesive granular soils, especially where slopes steepen significantly above 28 degrees. The typical debris avalanche exhibits four or five distinct zones occurring sequentially downslope, namely the failure, erosion, skim, free-fall, and deposition zones. Except in the erosion zone, root strength of forest trees appears to play little part in retarding debris avalanches because initiation commonly occurs beneath the root zone. (See also W91-06570) (Brunone-PTT)
W91-06586

EFFECTS OF TIMBER HARVESTING ON PROGRESSIVE HILLSLOPE DEFORMATION IN SOUTHWEST OREGON.
Pacific Northwest Forest and Range Experiment Station, Juneau, AK. Forestry Sciences Lab.
D. N. Swanston, G. W. Lienkaemper, R. C. Mersereau, and A. B. Levno.

IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 141-142. 2 ref.

Descriptors: *Erosion, *Forest management, *Forestry, *Logging, *Mass wasting, *Oregon, *Slope degradation, *Slopes, Correlation analysis, Field tests, Precipitation, Rainfall, Regression analysis, Seasonal variation, Soil water, Temporal variation, Timber harvesting.

Progressive hillslope deformation and any modifying effects of timber harvest operations were studied in the Baker Creek watershed, southwest Oregon during the 10-year period 1974 to 1984. Borehole inclinometer access tubes, installed in 1973 within and adjacent to a well defined earthflow, were monitored through the period bridging pre-logging, harvesting and post-logging activities in the watershed. Access tubes provided a means of placing an inclinometer at various points within the regolith to measure the differences in rate and mode of deformation with location within and around the earthflow feature. Movement within the earthflow mass was characterized by a 'block-glide' profile with uniform displacement occurring above a well-defined zone of shear 3 to 5 m in depth. No significant correlations were obtained from linear regression of either displacement or rate against seasonal and annual rainfall reported at nearby Powers, Oregon, suggesting that movement was progressing independently of short-term precipitation and was more responsive to long-term variations in precipitation and subsequent soil-water content in the regolith. A direct correlation exists between declining long-term rainfall and declining displacement at this undisturbed site. During 1978 to 1979, the earthflow responded to an additional destabilizing force that had accelerated displacement despite continued below-average, area-wide moisture availability. Accelerated movement within the earthflow continued until the fall of 1979, when displacement rates returned to pre-logging levels. (See also W91-06570) (Brunone-PTT)
W91-06587

FOREST DISTRIBUTION USED AS AN EROSION INDICATOR ON LARGE-SCALE LANDSLIDE SCARS.
Shizuoka Univ. (Japan). Dept. of Forestry.
H. Omura, and S. Mochizuki.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 143-144. 2 fig.

Descriptors: *Erosion, *Forest recovery, *Forests, *Japan, *Landslides, *Rockslides, *Soil erosion, Model studies, Resource management, Revegetation, Soil accumulation.

Natural recovery of large-scale scars of the rock slide type of landslide was investigated using forest distribution as an erosion indicator. The type and density of forest distributed on 26 large-scale landslides in the Akaishi mountain range, located in central Japan, were analyzed by field work and interpretation of aerial photographs taken in 1982. The forest lost by landslides was proportional to the landslide area. With increasing relative distance downslope, the percent of area in forest patches increases. Natural revegetation and the accumulation of soil may give an index of the recovery of forest at rock slide type of landslide sites. Based on forest distribution pattern as an erosion indicator at large-scale landslides in alpine areas, a model of the recovery of forest cover from the outlet toward scarp can be developed using the idea of relative distance necessary for protection of forest patches. (See also W91-06570) (Brunone-PTT)
W91-06588

FORESTED BLOCK SLIDES IN THE LOWER REDWOOD CREEK BASIN, NORTHWEST CALIFORNIA.
Redwood National Park, Orick, CA.
R. Sonnevil, R. Klein, D. Short, and W. Weaver.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 145-146. 5 ref.

Descriptors: *California, *Erosion, *Forests, *Geomorphology, *Landslides, *Mass wasting, *Redwood Creek Basin, *Sediments, *Slope degradation, Block slides, Cohesion, Field tests, Permeability, Rainy season, Soil permeability, Soil types, Storms.

Mass movement is an important process shaping landforms and producing sediment in the Redwood Creek basin, northwest California. Here, 35 active deep-seated landslides are occurring on schist terrane. Most block slides in the study area are discrete, translational landslides ranging in size from 0.4 to 2.0 ha. Annual surface displacement on three block slides has been measured with stakeline surveys since 1985. Data recorders have monitored surface displacement on portions of two block slides since 1984 and on a third slide since 1985. Common to nearly all block slides is a sheared, black, albite-muscovite-chlorite-quartz schist containing abundant carbonaceous material. Movement was detected near the boundary between this metamorphosed argillaceous rock and the overlying lighter colored regolith on three block slides. This preferential failure zone development is probably a result of lower permeability and greater cohesion in the underlying material. Movement of monitored block slides was episodic and storm-related, whereas earth flow movement has often persisted throughout most of the rainy season and, in some instances, during summer months. A higher clay content and consequent lower permeability may increase water retention and prolong movement duration of earth flows. Block slides appear to be important for sculpting schist terrane, producing many of the smaller, poorly incised first-order drainages common to this lithologic unit within the lower Redwood Creek basin. (See also W91-06570) (Brunone-PTT)
W91-06589

ESTIMATION OF DEBRIS FLOW HYDROGRAPH ON VARIED SLOPE BED.
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
T. Takahashi, H. Nakagawa, and S. Huang.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 167-177. 2 fig, 1 tab, 3 ref.

Descriptors: *Channel morphology, *Debris flow, *Erosion, *Geomorphology, *Hydrographs, Columbia, Mathematical analysis, Model studies, Mudflows, Nevado del Ruiz Volcano, Particle size, Sediment grading, Sediment load.

A system of equations with which to predict the hydrograph of a debris flow is presented for an arbitrary position in a channel whose bed varies in slope, width and thickness and is composed of a graded mixture of particles. This system can not only be used to estimate the hydrograph of a debris flow under an arbitrary water supply but to determine the change in concentration of particles in the flow by separating them into coarse and fine components. This change in the concentrations of the coarse and fine fractions produced by erosion and deposition may account for the formation of mud flows which contain little coarse sediment on well-graded sediment beds having an abundance of coarse materials. Applications of this system to laboratory experiments and to the huge mud flow generated by the eruption of the Nevado del Riuz Volcano in Colombia proved its usefulness. (See also W91-06570) (Author's abstract)
W91-06590

COMPUTER SIMULATIONS OF DEBRIS FLOW DEPOSITIONAL PROCESSES.
Public Works Research Inst., Tsukuba (Japan).
T. Mizuyama, and A. Yazawa.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 179-190. 15 fig, 5 ref.

Descriptors: *Computer models, *Debris flow, *Mathematical models, *Model studies, *Sedimentation, Alluvial fans, Channel morphology, Dam effects, Damage, Erosion control, Floods, Sediment transport.

The prediction of the deposition area of a debris flow is necessary for estimating damage, controlling land use, setting up warning and evacuation systems, and evaluating the effects of debris-flow control structures such as sabo (erosion-control) dams. Methods to predict debris-flow deposition area include topographical surveys, empirical methods based on depositional shape of past debris flows, physical model tests, and mathematical models. A mathematical model is described which is appropriate for evaluating the effects of micro-topography on fans. The model was improved to calculate the debris-flow depositional area more accurately on alluvial fans that have channels of comparatively large cross section. The inflow and outflow of sediment and water between channels and fan surfaces, calculated one-dimensionally, are used as the boundary conditions for the calculation of the debris-flow deposition on fan surfaces. (See also W91-06570) (Author's abstract)
W91-06591

MECHANISMS OF DEBRIS SUPPLY TO STEEP CHANNELS ALONG HOWE SOUND, SOUTHWEST BRITISH COLUMBIA.
British Columbia Univ., Vancouver. Dept. of Geography.
M. J. Bovis, and B. R. Dagg.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 191-200. 4 fig, 10 ref.

Descriptors: *British Columbia, *Channel morphology, *Debris flow, *Erosion, *Howe Sound, *Sedimentation, Deposition, Flooding, Model studies, Rainfall-runoff relationships, Rainstorms, Runoff, Slopes.

The mountain wall which forms the east slope of Howe Sound fjord, near Vancouver, British Columbia, is deeply dissected by steep creeks, many of which have produced destructive debris torrents over the past twenty years. The fact that high-magnitude torrents have occurred sporadically during rainstorms with only 2 to 3 year recurrence intervals suggests that, in addition to rainfall runoff, the quantity and stability of debris in the channels, together with large impulsive loads from adjacent slopes, must be taken into account when examining torrent occurrence. Research has focused on hillslope processes supplying debris and impulsive loads to the channels, and on the character of the materials involved. Debris supply was examined for selected basins classified as either 'rockslope-dominated' or 'drift-dominated'. Detailed studies of individual basins should provide more insight into the causes of debris torrents here than would rainfall-based and runoff-based models derived in other regions. (See also W91-06570) (Author's abstract)
W91-06592

CRITICAL RAINFALL (DANGER INDEX) FOR DISASTERS CAUSED BY DEBRIS FLOWS AND SLOPE FAILURES.
Kyoto Univ. (Japan).
S. Kobashi, and M. Suzuki.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 201-211. 13 fig, 4 ref.

Descriptors: *Debris flow, *Disasters, *Erosion, *Flood forecasting, *Landslides, *Rainfall, *Slope degradation, Mathematical analysis, Model studies, Rainfall intensity, Slope stability.

In order to forecast the occurrence of debris flows and slope failures, the rainfall characteristics that have caused mass wasting in Japan in the past were analyzed. The occurrence of slope failures and debris flows is related to the amount of water stored in the surface layer (slope failure) or in the stream bed (debris flows). The danger index of rainfall should be related to the amount of water

stored in surface layer that fails. Calculating the degrees of danger hourly, according to changes in rainfall intensity, is necessary so that disaster warnings can be given promptly. Using a tank model and the concept of effective rainfall, the critical rainfall (danger index) for mountain regions was developed. The most suitable criteria for danger index and the probability of occurrence of disasters by the degree of slope stability were also investigated. When the accumulative amount of hourly effective rainfall over 60 mm (SE60) exceeds 200 mm, the failure ration increases quickly. (See also W91-06570) (Brunone-PTT)
W91-06593

SEDIMENT ROUTING BY DEBRIS FLOW.
Washington Univ., Seattle. Dept. of Geological Sciences.
L. Benda, and T. Dunne.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 213-223. 2 fig, 16 ref.

Descriptors: *Debris flow, *Erosion, *Geomorphology, *Mass wasting, *Oregon, *Sediment transport, Aggradation, Alluvial channels, Bedrock, Channel armoring, Channel erosion, Channels, Colluvial soils, Debris basins, Hollows, Landslides, Recurrence intervals.

Forty-six debris flows in a fifth-order basin in the Oregon Coast Range, were studied to determine the role and significance of debris flows in sediment routing. Dating of charcoal from basal colluvium in three bedrock hollows and in one first-order channel yielded an average landslide recurrence interval of approximately 6000 years, and resulted in recurrence intervals of debris flows in first-order and second-order channels of respectively 1500 and 750 years. These time intervals were used to construct sediment budgets for first-order and second-order basins, which, in conjunction with textural analyses of colluvium in hollows and sediments in channels, indicated that first-order and second-order basins store the majority of sediments supplied to them by mass wasting and release it periodically by debris flows. The transport of a majority of sediments to third-order and higher-order channels by debris flows implies a strong stochastic character in the routing of sediments through basins that may include alluvial channels alternating between conditions of aggradation and degradation and armoring over time scales of 100 to 1000 years. (See also W91-06570) (Author's abstract)
W91-06594

LARGE-SCALE DEBRIS AVALANCHE AS AN EPISODE IN SLOPE-CHANNEL PROCESSES.
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
K. Okunishi, S. Okuda, and H. Suwa.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 225-232. 3 fig, 12 ref.

Descriptors: *Avalanches, *Channel erosion, *Debris flow, *Geomorphology, *Japan, *Sediment transport, Channels, Check dams, Slope degradation, Topography, Travel distance.

The sequence of topographic changes and the associated mass transport induced by a large-scale debris avalanche, discussed from a geomorphic viewpoint, was used to assess the possible topographic changes in a drainage basin. A debris avalanche which travelled down the Denjo River on the southern slope of Mt. Ontake, Japan, following an earthquake presents a good example, because the occurrence, flow characteristics and resultant topographic changes have been intensively investigated. The structure and mechanical properties of the debris avalanche were estimated from field evidence to provide a method for predicting the travel distance. The current trend of topographic changes was reviewed to predict long-term changes on the slopes and on the valley floor, and to consider interactions between slope processes and fluvial processes. The present channel processes in the affected reaches and the downstream reaches appear to have been regulated successfully by a series of debris barriers and check dams constructed after the event. (See also W91-06570) (Author's abstract)
W91-06595

EROSION PROCESSES AND EFFECTS OF DEBRIS FLOW.
Chengdu Inst. of Geography (China).
Z. Kang, and J. Li.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 233-242.

Descriptors: *Debris flow, *Erosion, *Sediment transport, Channel erosion, Debris basins, Desertification, Disasters, Floods, Gravity erosion, River basins, Sediment yield, Sedimentation, Slope degradation, Vegetation.

Debris flows are rapid mass movements and a powerful dynamic erosion process which poses extreme hazards to human lives and engineering developments, cause severe environmental problems, and destroy ecological balance. Debris flows can cause deterioration of land and decreased vegetative cover leading to desertification. The erosion mechanisms of debris flows are discussed in terms of erosion mode (slope erosion, gravity erosion, channel erosion), quantity of sediment, and erosion rate. The sediment yield and rate of sediment production were obtained from erosion and sediment transport rates and sediment delivery ratios. Debris-flow basins, differing greatly from river basins, are areas most vulnerable to erosion. The sediment delivery rate in low-frequency debris-flow basins is very small in normal years but this low transport rate has a profound accumulative effect by providing sediment for a debris flow during a catastrophic flood. (See also W91-06570) (Brunone-PTT)
W91-06596

MOBILIZATION OF DEBRIS FLOWS FROM SHALLOW SLIDES.
Geological Survey, Menlo Park, CA.
S. D. Ellen, R. W. Fleming, and H. J. Lee.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 243-244. 1 fig, 6 ref.

Descriptors: *Debris flow, *Erosion, *Landslides, *Mass wasting, *Sediment transport, *Slope degradation, Cohesion, Model studies, Saturated soils, Soil mechanics, Soil physical properties.

Predicting the mobilization of debris flows from shallow slides is critical to evaluating landslide hazard, because the transformation from slide to flow largely determines the velocity and travel distance of mass movements. The transformation from slide to flow can be explained using critical-state soil mechanics to described changes in void ratio and effective confining stress during the deformation that accompanies failure. Mobilization may be obtained by either contractive or dilative soil. Mobilization of loose soil should be essentially instantaneous. The entire slide mass should mobilize because strength is greatly reduced upon a small strain. Mobilization of dilative soil will be slower because the void ratio, and hence water content, must increase. The potential for mobilization can be evaluated by determination of the ratio of saturated water content to liquid limit as an approximate mobility index. (See also W91-06570) (Brunone-PTT)
W91-06597

EXPERIMENTAL STUDY ON THE PHENOMENA OF RAIN INFILTRATION.
National Research Center for Disaster Prevention, Sakura (Japan).
For primary bibliographic entry see Field 2B.
W91-06598

HYDROMECHANICAL EROSION MODEL FOR SURFACE-MINED AREAS.
National Pingtung Inst. of Agriculture (Taiwan).
For primary bibliographic entry see Field 4C.
W91-06599

SEDIMENT YIELD FROM BARE SLOPES DUE TO LANDSLIDES IN CENTRAL JAPAN.
Kyoto Univ. (Japan). Faculty of Agriculture.
K. Mizuhara, and K. Ohte.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 251-252. 1 fig, 1 ref.

Descriptors: *Erosion, *Japan, *Landslides, *Rainfall, *Sediment yield, *Slope degradation, *Soil erosion, Air temperature, Debris basins, Disasters, Erosion control, Rainfall intensity, Storage dams, Temporal variation.

High sediment yield due to landslides during heavy rainfall is a matter of great concern in erosion control planning. An additional source of sediment is the bare slope formed after the landslide. Sediment produced from these slopes may shorten the lifetime of storage dams or bring about sediment-related disasters in certain cases. The changing phase of the average volume of ground-surface deformation per day, average rainfall per rain-day, and average minimum temperature per day were measured. The relationship between the negative values of deformation-volume and rainfall intensity is different before and after the month of maximum erosion. Positive values of deformation-volume are closely related to the drop intemperature. The amount of deposition depended on the value of the product of the average minimum temperature per day and the number of frost days in the measuring period. The volume of ground-surface deformation has a tendency to change cyclically over a year. The average annual erosion depth ranged from 0.69 to 1.16 cm/year and the mean value was 0.93 cm/year. (See also W91-06570) (Brunone-PTT)
W91-06600

ASSESSMENT OF TRANSFERABILITY OF USLE TO TAIWAN.
National Chunghsing Univ., Taichung (Taiwan).
S. L. Liang.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 253-254. 1 fig, 1 tab, 2 ref.

Descriptors: *Erosion, *Slopes, *Soil erosion, *Taiwan, *Universal soil loss equation, Field tests, Runoff, Soil texture, Soil types.

The application of the Universal Soil Loss Equation (USLE) to steep slopes is needed throughout the world, and especially for Taiwan which suffers from erosional damage. Before the USLE can be used, the method's applicability must be determined for bare plots of steep slopes up to 28 degrees. Eight bare plots, with a soil texture of loam/silty-loam and varying slopes, were selected. Runoff samplers were installed to determine soil loss from each plot. The relationships among the predicted soil loss, the observed soil loss, and the slope steepness indicate that the scaling of the USLE index is inappropriate for steep slope conditions. (See also W91-06570) (Brunone-PTT)
W91-06601

STUDY OF EROSION OF LATERITIC SOIL OF LINKOU TERRACE.
National Taiwan Univ., Taipei. Dept. of Civil Engineering.
R. H. Chen, and J. S. Yang.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 255-256.

Descriptors: *Acid rain effects, *Erosion, *Laterites, *Linkou Terrace, *Soil erosion, *Taiwan, Dispersion, Erosion control, Hydrogen ion concentration, Infiltration rate, Ion adsorption, Leaching, Rainfall, Slope stability, Soil water, Weathering.

The erosion properties of the lateritic soil of Linkou Terrace, located in northwestern Taiwan, were investigated so that erosion problems in the area can be better controlled. Both physical and chemical methods were used to evaluate surface erosion and infiltration. Erosion of lateritic soil by infiltrating water was studied by the US Soil Conservation Service dispersion test, determination of sodium absorption ratio of the soil, and the pinhole test. A rain simulator was used to erode artificial slopes. Leaching studies estimated the concentration of sodium and iron ions after application of various chemical reagents to simulate acid rain. Results showed that the dispersive potential of lateritic soil is very small. Dry-wet cycles affect the resistance of lateritic soil to erosion, with erosion rates greater for drier slopes, steeper slopes, and slopes subjected to more dry-wet cycles and longer durations of rainfall. The erosive potential of the lateritic gravel revealed two types of weathering patterns, with a slow digestion process. Leaching tests showed that fresh lateritic soil would be more influenced by acid rain than weathered slopes; solutions of low pH value would have more influence; wet slopes are more influenced than slopes with low water content; and, the amount of sodium ions leached decreased with increasing soil depth, while the amount of iron ion increases. (See also W91-06570) (Brunone-PTT)
W91-06602

SOIL LOSSES AND RUNOFF RATES FROM THE FORESTED WATERSHEDS IN KOREA.
Seoul National Univ. (Republic of Korea). Dept. of Forestry.
B. M. Woo.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 257-258. 1 tab, 4 ref.

Descriptors: *Erosion, *Forest watersheds, *Korea, *Rainfall-runoff relationships, *Runoff, *Soil erosion, Gages, Irrigation reservoirs, Precipitation, Sedimentation, Sedimentation rates, Topography.

A study investigated the influence of forests on soil loss and runoff from small watersheds generally with upper elevation forest types. About 10 major experimental field projects dealing with soil loss and runoff from upper elevation forested watersheds have been conducted in Korea. Average annual precipitation for all projects identified ranges from about 1000 to 1550 mm. The ratios of average annual surface runoff to annual precipitation range from 44 to 55% for forested watersheds to 60 to 70% for sloping, denuded watersheds. Soil losses and runoff rates varied greatly depending on watershed topography and vegetation. To improve the reliability of extrapolation of these results for Korea as a whole, the Forest Research Institute or another government agency should install at least two additional gaging stations near Jinju in the southern region. Soil loss rates from the forested watersheds are much smaller than the rates of sedimentation observed in irrigation reservoirs downstream. (See also W91-06570) (Brunone-PTT)
W91-06603

INCREASED SEDIMENTATION FOLLOWING HELICOPTER LOGGING AND PRESCRIBED BURNING ON GRANITIC SOIL.
Intermountain Forest and Range Experiment Station, Boise, ID.
W. F. Megahan.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 259-260. 2 ref.

Descriptors: *Clear-cutting, *Forestry, *Logging, *Prescribed burning, *Sediment yield, *Sedimentation, *Soil erosion, Catchments, Channel erosion, Channel morphology, Check dams, Dam effects, Drainage, Runoff, Snowmelt, Statistical analysis, Streamflow, Water yield.

A study was conducted to evaluate the effects of clearcut logging by helicopter, and associated prescribed burning, on sediment yields. A paired catchment study design was used, and the study site was located in the headwaters of the Payette River basin in south-central Idaho. Data collection for streamflow and sediment yields began in 1965 and continued through 1976 when the larger basin was logged. Sedimentation yields were determined using sediment detention basins at the mouth of each drainage. Annual sediment yields show a statistically significant increase, averaging about 100%, as a result of the timber harvest, with the greatest effects occurring during years with the highest sediment yields. Accelerated sedimentation continued to persist nine years after logging. Following logging, no statistically significant differences in channel cross sections existed, nor did the volume of sediment stored behind natural obstructions in the channel change, suggesting that the increased sedimentation was not caused by accelerated channel erosion. Both annual water yields and peak flow rates were unaffected by logging even though snowmelt runoff occurred earlier in the spring. (See also W91-06570) (Brunone-PTT)
W91-06604

SEDIMENT YIELDS AND SURFACE RUNOFF FROM SIX TYPES OF AGROFORESTRY AT MAE-KLONG WATERSHED RESEARCH STATION, KANCHANABURI, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Watershed Management Div.
P. Saengkoovong.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 261. 1 tab.

Descriptors: *Agronomy, *Erosion, *Forestry, *Land use, *Sediment yield, *Soil erosion, *Surface runoff, *Thailand, Agriculture, Canopy cover, Comparison studies, Plant growth, Root development.

Sediment yields and surface runoff were measured from sample plots with six types of agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand. The data indicate that canopy cover, root area, height of plant, growth rate, and shape of plant influenced soil and water losses from sample plots. Sediment yields (in kg/ha/yr) and surface runoff (in cubic m/ha/yr) for the six types of agroforestry were as follows: (1) Azadirachta indica and cotton, 3930 and 890; (2) Parkia javanica and corn, 3860 and 870; (3) Eucalyptus camaldulensis and cotton, 3390 and 1290; (4) Eucalyptus camaldulensis and corn, 3220 and 1240; (5) Leucaena leucocephala, corn and miliet, 2630 and 860; and (6) Parkia javanica, field rice, and cotton, 2010 and 710. (See also W91-06570) (Brunone-PTT)
W91-06605

TEST OF A SURFACE RUNOFF AND SOIL EROSION MODEL FOR FOREST ROAD SURFACES.
Washington Univ., Seattle. Coll. of Forest Resources.
W. Zhang, and T. W. Cundy.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 263-264. 1 fig, 4 ref.

Descriptors: *Cohesionless soils, *Erosion, *Forests, *Mathematical models, *Model studies, *Roads, *Soil erosion, *Surface runoff, Flumes, Hydrographs, Prediction, Sediment discharge, Sediment transport.

A physically based mathematical model of surface runoff and soil erosion on a plane with cohesionless soil is presented, which has been calibrated and tested for both steady flow and unsteady flow in flume experiments. For each run, the hydrograph and sediment discharge data were collected for entire rainfall runoff event. The simulated results from both uniform and mixture size versus the observed data show poor to fairly good agreement for the three runs on 1.2% slope and good agreement for the runs on the slope angles of 6.3 to 12.3%. Comparison of the results predicted by the model and observed data indicate that the model gave very good predictions for sediment transport. Since the model was developed under the assumption of an infinite supply of non-cohesive soil, it gave poor predictions for sediment transport on some of the lightly used and moderately used roads, where a limited supply of sediment existed at the surface. Therefore, application of the model requires incorporation of the sediment supply resulting from actual or anticipated road use. (See also W91-06570) (Brunone-PTT)
W91-06606

ESTIMATING DISCHARGE AND SEDIMENT YIELD FROM A FOREST ROAD.
Kyoto Univ. (Japan). Dept. of Forestry.
Y. Fukushima.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 265-266. 3 fig, 1 tab, 3 ref.

Descriptors: *Erosion, *Forests, *Roads, *Sediment yield, *Soil erosion, Drainage, Landslides, Prediction, Rainfall, Rainfall-runoff relationships, Road construction, Roughness, Runoff, Soil conservation, Soil properties.

A forest road is used not only for the transportation of harvested wood, but also for the management of the forest. Soil conservation problems include erosion on the road surface and landsliding from fill banks caused by road drainage. Discharge and sediment yield from a forest road for one year at two observation sites were investigated. The ratios of direct runoff to rainfall amount were high at both sites. The Manning's equivalent roughness was calculated at $N = 0.05$, using the kinematic wave method. These results indicate that if rainfall conditions and soil properties are known, surface discharge and sediment yield can be predicted for forest roads. Such estimates would be useful for the planning of cross drains for forest roads. (See also W91-06570) (Brunone-PTT)
W91-06607

EROSIONAL EFFECTS OF ROAD CONSTRUCTION IN PI-LU EXPERIMENTAL WATERSHED.
Thu-Thai Associates, Inc., Taipei (Taiwan).
Y. L. Lin.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 267-268. 1 tab, 2 ref.

Descriptors: *Erosion, *Road construction, *Sediment yield, *Taiwan, Channels, Check dams, Forest watersheds, Sediment sampler, Sedimentation, Watersheds, Weirs.

The effects of road construction were tested on sediment yield in a headwater conservation-forest watershed in central Taiwan. Pi-Lu Experimental Watershed is located in the middle of the central mountain range of Taiwan. Sediment trapped in the weirs at the mouth of the two subbasins was collected and weighed for four years before commencing road construction. The road was built along the 2600 m above mean sea level contour within the watershed. At the same time, 18 check dams were installed in various segments of channels within the watersheds. Sediment deposited in the weirs and check dams after the beginning of road construction was collected and volumes were estimated. Road construction did not significantly change the average annual amount of sediment trapped in the weirs. Road construction excavated 54,374 cub m of the spoils, of which 18,795 cu m or 34% were retained in check dams during 6 years of observation. The rock debris that did not reach the channels could be a potential source of sediment in the future. (See also W91-06570) (Brunone-PTT)
W91-06608

EROSION AND SEDIMENT TRANSPORT BY WINDTHROW IN A MOUNTAIN BEECH FOREST, NEW ZEALAND.
Louisiana Tech Univ., Ruston. Dept. of Geosciences.

S. F. Burns, and P. J. Tonkin.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 269-270. 3 ref.

Descriptors: *Erosion, *Forests, *New Zealand, *Sediment transport, *Wind erosion, *Windthrow, Mound topography, Plant growth, Root development, Sediment yield, Soil movement.

Windthrow, the uprooting of trees by wind, is the dominant forest regeneration process in many beech forests in New Zealand. A three part study investigated windthrow effects on soil distribution, root ecology, and sediment transport in a virgin forest. At the study sites of recent windthrow activity, the dimensions of the earth balls, pits, and the diameter at breast height (DBH) were recorded. At sites of ancient windthrow activity, the three-dimensional measurements of the pits and mounds and their percent of coverage of the forest floor were noted. At the recent windthrow sites, there are statistically significant relationships between the size of the tree, as determined by DBH, the volume of the earth ball, and the dimensions of the resulting pits and mounds. Pit and mound topography was absent from northwest-facing slopes and sites near treeline. Using forest regeneration values of 100 to 280 years, ranges of sediment transport rates have been calculated as equivalent to a sheet of debris 11 to 13 mm thick moving down the slope 1.3 to 1.8 m. Therefore, in the last 8000 years since deglaciation, this layer has moved 35 to 145 m. The resulting sediment yield from windthrow is 0.4 to 1.3 cu m/km/yr, which is more than three orders of magnitude less than nearby slopes where grasses and shrubs have invaded after the forest was removed. (See also W91-06570) (Brunone-PTT)
W91-06609

SEDIMENTOLOGICAL APPROACH TO EXAMINING SEDIMENTS/SOILS ON HILLSLOPES: EXAMPLES FROM PAPUA NEW GUINEA AND AUSTRALIA.
Papua New Guinea Univ., Port Moresby. Dept. of Geography.
G. S. Humphreys.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 271-272. 1 ref.

Descriptors: *Australia, *Papua New Guinea, *Sedimentology, *Slopes, *Soil genesis, Field tests, Runoff, Sandstones, Soil profiles, Soil structure, Soil texture, Stratigraphy, Subsoil, Surface mounding.

Two sites, contrasting in tectonic and environmental setting and lithology, are used to show that a sedimentological approach to soil stratigraphy, combined with an evaluation of contemporary process studies, is useful in determining the origin of soils on hillslopes. At monsoonal Port Moresby, Papua New Guinea, hillslope deposits have been examined on 5 to 45 degree slopes formed on steeply dipping and thrust-faulted mudstones. Near Sydney, Australia, hillslope deposits have been examined on 0 to 25 degree slopes formed on dissected, flat-lying quartzose sandstones. By mapping the distribution of soil materials in the landscape in terms of layers and not soil profiles, both sites display (a) an unconformable relationship between a coarser textured upper layer and a subsoil, (b) the existence of proximal and distal facies in the upper layer, (c) sedentary nature of the subsoil inherited directly from the bedrock. Field experiments show that a combination of rainwash and biologically induced surface mounding is responsible for mobility at the Sydney site, whereas soil creep and other mass movement processes are of negligible importance. At the Port Moresby site, shallow debris avalanching combined with rainwash and biological activity appear to be important in explaining the formation of the sediment wedge and contemporary movement in the near surface layer or topsoil; soil creep in the form of plastic deformation appears important at or near the interface. (See also W91-06570) (Brunone-PTT)
W91-06610

POSTFIRE SEDIMENT MOVEMENT BY DEBRIS FLOWS IN THE SANTA YNEZ MOUNTAINS, CALIFORNIA.
Pacific Southwest Forest and Range Experiment Station, Riverside, CA.
W. G. Wells, P. H. Wohlgemuth, A. G. Campbell, and F. H. Weirich.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 275-276. 1 ref.

Descriptors: *California, *Debris flow, *Erosion, *Fire effects, *Geomorphology, *Sediment transport, *Sedimentation, Channel deposition, Discriminant analysis, Flow rates, Morphometry, Rainfall intensity, Santa Ynez Mountains, Seasonal variation.

In coastal southern California, erosion and sedimentation increase by an order or magnitude or more after fire. The Wheeler Fire of July, 1985, which burned a large area of the Santa Ynez Mountains in Ventura and Santa Barbara Counties, provided an opportunity to investigate postfire erosion and sediment transport processes in a different environmental setting. During the rainy season, reconnaissance surveys and examinations of fresh channel deposits were used to evaluate debris flow occurrences in 109 basins throughout the burned area. The morphometric analysis of topographic maps provided the drainage area, relief ratio, elongation ratio and drainage density of these 109 basins. The relationship of these morphometric parameters to debris flow occurrences was then evaluated using discriminant analysis. Results of the debris flow reconnaissance surveys indicate that 71 of 109 basins experienced at least one debris flow during the winter rainy season. These debris flows occurred in response to relatively low rainfall intensities. Results of the discriminant analysis suggest that debris flow occurrence had a positive relationship with relief ratio and a negative relationship with basin area. Debris flows are a common mode of postfire sediment transport in southern California. In the Santa Ynez Mountains they tended to be associated with the smaller and steeper watersheds. An important feature of these debris flows is that they did not require high rainfall intensities normally associated with debris flow occurrence. (See also W91-06570) (Brunone-PTT)
W91-06611

POST-FIRE RESPONSE OF A BOULDER-BED CHANNEL.
Pacific Southwest Forest and Range Experiment Station, Riverside, CA.
A. G. Campbell, P. M. Wohlgemuth, and W. G. Wells.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 277-278. 1 fig, 1 ref.

Descriptors: *Boulder-bed streams, *California, *Erosion, *Fire effects, *Flow rates, *Santa Ynez River, Aggradation, Catchment basins, Channel morphology, Precipitation, Scour, Slope degradation, Slopes, Surface runoff.

Following brushfires in southern California steeplands, peak discharges increase substantially, and hillslope erosion processes are greatly accelerated. To investigate the post-fire response of a boulder-bed channel in southern California, a study was initiated in a 4 sq km portion of the Santa Ynez River drainage basin that burned in the disastrous Wheeler Fire of July 1985. Four representative channel reaches were selected, and four to six cross sections were established at 20 m intervals in each for a total of 20 cross sections. A sequence of fill and scour occurred at most of the cross sections. The early storms produced aggradation, while later storms resulted in degradation. This pattern of fill and scour may be related to changing hillslope erosion rates and variations in precipitation. Although the general pattern of channel response was aggradation followed by degradation, the response at individual cross sections varied. During a given runoff event, cross sections in close proximity behaved differently; certain cross sections aggraded while others scoured. In summary, the post-fire response of this channel may have been related to changing erodibility of slopes that were actively recovering, variations in precipitation, and the distribution of boulders along the stream channel. (See also W91-06570) (Brunone-PTT)
W91-06612

RELATIONSHIPS BETWEEN CHANNEL MORPHOLOGY, UNIT STREAM POWER, AND SEDIMENT ROUTING AND STORAGE IN A STEEP, BEDROCK CONTROLLED CHANNEL.
California Univ., Santa Barbara. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2E.
W91-06613

TEMPORAL AND SPATIAL VARIABILITY OF SEDIMENT STORAGE AND EROSION IN ASH CREEK, ARIZONA.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
M. D. Harvey, J. Pitlick, and J. Laird.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 281-282. 2 ref.

Descriptors: *Arizona, *Ash Creek, *Channel storage, *Erosion, *Sediment transport, *Sedimentation, *Spatial distribution, *Temporal variation, Alluvial fans, Catchment basins, Dendrochronology, Field tests, Flow rates, Semiarid lands, Streamflow, Wolman counts.

A 2868 m long reach of Ash Creek in Arizona was studied to determine the temporal and spatial variability of sediment routing in a stream draining a semi-arid, chaparral-vegetated, drainage basin. Topographic surveys of the study reach were made in March and August, 1986. Eight cross sections were surveyed, and sediment samples were collected from the terraces and in the alluvial reach. Wolman counts were made in the cobble-and-boulder bedded reach. Tree ages fall into two groups (67 to 51 years, and 26 to 5 years) which represent two cycles of degradation. Unlike erosion of many arroyo fills in the southwestern US, the sediment stored in Ash Creek has been removed by a downstream progression of erosion. Dendrochronologic data show the degradation period of a 2.8 km reach was on the order of several decades. (See also W91-06570) (Brunone-PTT)
W91-06614

SEDIMENT TRANSPORT AND DEPOSITION BY FIRE-RELATED DEBRIS FLOWS IN SOUTHERN CALIFORNIA.
California Univ., Los Angeles. Dept. of Geography.
F. H. Weirich.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 283-284.

Descriptors: *California, *Debris flow, *Fire effects, *Reservoirs, *Sediment distribution, *Sediment transport, *Turbidity currents, Flow rates, Hydraulic jump, Lakes, Sediment sampler, Sediment yield.

While fire-related debris flows have been the subject of extensive investigation, detailed process data is still lacking. The subaerial and subaqueous transport and deposition of sediment by fire-related flows was investigated in a series of sub-basins and reservoirs within the San Dimas Experimental Forest near Los Angeles. The streams emerging from each of the six basins were instrumented with newly designed, continuous record, sediment concentration sensors as well as conventional flow and temperature sensors. In agreement with other stud-

ies, fire-related debris flows may be initiated after only moderately intense rainfalls. Once initiated, the relatively fluid flows move with velocities on the order of 4 to 8 m/sec down the channels and in some cases reach the reservoirs themselves. The sediment concentrations of the flows, measured continuously, exceed 60% by weight. These same debris flows are able to move subaqueously substantial distances across the floor of the reservoir. In some cases the flows undergo subaqueous hydraulic jumps resulting in the conversion to turbidity currents with the subsequent rapid outfall of large amounts of sediment. The actual subaqueous run-out distance of the flows and depositional pattern is controlled by the location of the hydraulic jump. These results provide a better understanding of fire-related sediment yields and deposition processes in lakes and reservoirs. (See also W91-06570) (Brunone-PTT)
W91-06615

OVERVIEW: CHANNEL MORPHOLOGY AND SEDIMENT TRANSPORT IN STEEPLAND STREAMS.
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
For primary bibliographic entry see Field 2E.
W91-06616

INITIAL MOTION OF COARSE SEDIMENT IN STREAMS OF HIGH GRADIENT.
Washington Univ., Seattle. Dept. of Geophysics.
P. L. Wiberg, and J. D. Smith.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 299-308. 4 fig, 1 tab, 11 ref.

Descriptors: *Boundary processes, *Mathematical models, *Model studies, *Sediment transport, *Shear stress, *Streams, Eddy coefficient, Field tests, Flow rates, Particle size, Size distribution.

A method for calculating the boundary shear stress necessary to set clasts of various sizes in motion is presented for steep mountain streams, a situation in which the Shields technique breaks down. Critical shear stress is calculated from a balance of forces acting on a sediment particle at the bed, in which an appropriate velocity profile and the effects of mixed grain sizes are explicitly included. An algorithm for estimating the most probable velocity structure in flows with large obstacles produces quasi-linear velocity profiles that yield reasonable critical shear stress values when incorporated in the force balance equation. Further refinement requires first making careful field measurements of flow depths, velocity fields, and particle size distributions simultaneously in some steep, coarse-bedded streams so that the proper eddy coefficient characterizing these flows can be determined. In addition, field measurements for the estimation of critical shear stress should include information about the size distribution present on the bed and the estimated flow depth at the time of initial motion. (See also W91-06570) (Brunone-PTT)
W91-06617

CRITICAL CONDITIONS FOR BED MATERIAL MOVEMENT IN STEEP, BOULDER-BED STREAMS.
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
J. C. Bathurst.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 309-318. 4 fig, 2 tab, 15 ref. NATO Grant 092/84.

Descriptors: *Bed-load discharge, *Boulder-bed streams, *Particle size, Channel morphology, Field tests, Flow rates, Mathematical analysis, Mountain streams, Sediment transport, Shear stress.

In bed materials with nonuniform size distributions, particles smaller than a particular reference size are relatively difficult to move while particles larger are relatively easy to move. In addition, at steep slopes, the critical conditions for movement are best predicted by an approach based on water discharge rather than the Shields shear stress. These two conditions are combined empirically to form a method of calculating critical unit water discharge for particle movement in steep channels with coarse nonuniform bed material. The relationship between particle size and critical unit water discharge was evaluated using field data and is found to vary with bed material size distribution. The reference diameter is of the order of bed material D50 size. An independent test of the relationships indicates good results if the unit water discharge is based on the active width for bed load transport rather than on flow width. (See also W91-06570) (Author's abstract)
W91-06618

MODELLING BED-LOAD TRANSPORT IN STEEP MOUNTAIN STREAMS.
Ministry of Works and Development, Lower Hutt (New Zealand). Central Labs.
J. G. Whittaker.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 319-332. 7 fig, 17 ref.

Descriptors: *Bed-load discharge, *Channel morphology, *Model studies, *Mountain streams, *Sediment transport, Bed load, Channel scour, Geomorphology, Pools.

Steep mountain streams often exhibit a characteristic step-pools structure, which itself gives rise to the distinctive tumbling flow pattern. Bed-load transport processes in such streams are strongly linked to the bed configuration. Typically derived from limited input sites, bed load tends to move through the stream system as waves. Step-pools streams were modelled and clear water scour and sediment transport processes studied. Results were used to develop an equation for predicting sediment transport rates in step-pool streams. Difficulties exist in applying the step-pool equation to prototype streams, largely because of differences between the prototype stream's geomorphology and the structure of the laboratory idealization. Despite the error that will result in field application of the equation, its field application offers distinct advantages, including greater accuracy than methods used to date. The applicability of these idealized model results to prototype step-pool streams was examined, showing that work is required on adapting the model to reflect field conditions more correctly. (See also W91-06570) (Brunone-PTT)
W91-06619

BED LOAD TRANSFER AND CHANNEL MORPHOLOGY IN BRAIDED STREAMS.
Saskatchewan Univ., Saskatoon. Dept. of Geography.
P. Ashmore.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 333-341. 5 fig, 7 ref.

Descriptors: *Bed-load discharge, *Braided streams, *Channel morphology, *Hydraulic models, *Model studies, *Sediment transport, Aggradation, Channel erosion, Degradation, Flow rates, Photography, Sedimentation, Temporal variation.

Observations of bed load transport rates in hydraulic models of gravel braided streams run at constant discharge reveal the existence of regular fluctuations in the transport rate with periods of a few hours. This periodicity is too great to be attributable to the passage of individual gravel bars or sheets. Time-lapse photography and channel pattern measurements reveal that an increase in the bed load transport rate into a given reach causes local aggradation, increased braiding intensity, more frequent channel avulsion and the appearance of groups of migratory bars. As each sediment pulse passes, degradation commences and a portion of the deposit sediment is removed to another aggradational site downstream. The presence of alternating zones of diverging and converging flow is important in determining the location of these sites. The process of transfer of bed load pulses is a key element of braided river mechanics. (See also W91-06570) (Author's abstract)
W91-06620

INFLUENCE OF LARGE ORGANIC DEBRIS ON CHANNEL RECOVERY IN THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA, CANADA.
For primary bibliographic entry see Field 4C.
W91-06621

INFLUENCE OF RIVER CHANNEL MORPHOLOGY AND SEDIMENT PRODUCTION ON RESIDENCE TIME AND TRANSPORT DISTANCE.
Hokkaido Univ., Sapporo (Japan). Dept. of Forestry.
F. Nakamura, T. Araya, and S. Higashi.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 355-364. 3 fig, 4 tab, 6 ref.

Descriptors: *Channel morphology, *Residence time, *Rivers, *Sediment transport, *Sedimentation, Channel erosion, Channel storage, Erosion, Japan, Mountain streams, Scour, Spectral analysis, Streambeds.

Transport and storage processes of sediment in a river channel should be integrated to construct a sediment budget. Residence time (tr) and erosion rate (Fo), which were evaluated from the age distribution of sedimentin five rivers in mountainous regions of Japan were considered to be affected by river channel morphology and sediment production. Sediment transport occurs as scouring and deposition takes place alternately on a riverbed, with the resultant formation of waves. Assuming that a dominant wavelength found by a spectral analysis equals a transport distance of sediment (Dr), then Dr/tr equals a transport distance per year, which is one of the criteria to indicate a characteristic of storage and transport processes of sediment. Comparison between the upper and the lower reach indicated that tr and Dr increase with an increase in distance from upstream. (See also W91-06570) (Author's abstract)
W91-06622

GEOMORPHIC INFLUENCES ON SEDIMENT TRANSPORT IN THE WILLAMETTE RIVER.
Oregon State Univ., Corvallis.
P. C. Klingeman.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 365-374. 6 ref.

Descriptors: *Alluvial channels, *Channel morphology, *Geomorphology, *Sediment transport, *Willamette River, Bank stabilization, Bedrock, Channel scour, Channel stability, Gravel mining, Meanders, Reservoirs, Riprap, Scour, Sediment deposition, Stream banks, Streambeds, Tributaries.

The Willamette River in Oregon and the downstream reaches of all of its tributaries have alluvial channels that consist of material quite susceptible to scour, transport and redeposition. The sediment transport regime is highly dynamic, simultaneously reflecting past and present influences that have residual effects measurable in years or decades. The Willamette River streambed is well armored and stable for most river discharges. Consequently, the downstream movement of main-stem Willamette River bed material appears to be quite limited. Major natural influences include the river's recent geological history, meandering, natural streambed armoring, constraints on bedform development due to natural channel constrictions, and the presence of bedrock outcrops and old cemented gravels. Major human influences include bank stabilization revetments, gravel mining activities, and upstream reservoir regulation. Together, these influences are modifying the Willamette's channel morphology

and sediment transport regime. (See also W91-06570) (Brunone-PTT)
W91-06623

NEW MODELS OF HYDROLOGICAL AND STREAM CHANNEL RELATIONSHIPS.
Washington State Univ., Pullman.
For primary bibliographic entry see Field 2E.
W91-06624

HYDRAULICS AND TRANSPORT AT HIGH FINE SEDIMENT LOADS.
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. B. Bradley.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 385-386. 2 fig, 4 ref.

Descriptors: *Hydraulic models, *Model studies, *Particle size, *Sediment transport, *Suspended load, Bed-load discharge, Boundary processes, Flow characteristics, Flow rates, Flumes, Hydraulic properties, Laboratory methods, Mudflows.

The presence of high fine suspended sediment concentration can affect stream hydraulics and sediment transport capacity. A laboratory study was conducted for steady uniform flow using high concentrations of viscous bentonite as washload, and sand as bedload. This flume study included turbulent sediment-laden or hyperconcentrated flow runs, and two laminar mud flow runs. The turbulent-laminar transition can be determined for such flows using a friction factor-Reynolds number-yield stress index relationship. Once the flow regime is determined, laminar or turbulent resistance equations may be applied. In the fixed bed runs, vertical sand distributions were supply-limited and uniform in nature. The mobile dune and plane bed runs had comparable 'Z' values for measured and computed cases in turbulent hyperconcentrated flows. Computed values were developed from the Rouse equation, using a modified fall velocity to reflect changes in fluid properties. Flume data which differ in unit transport two orders of magnitude can be classed in three general categories. The clear water and clay cemented dune runs give the lowest transport rate, followed by plane bed, low fines concentration unit discharges. Laminar mud flow give the highest rate. (See also W91-06570) (Brunone-PTT)
W91-06625

RESPONSE OF BED TOPOGRAPHY TO INCREASED BED LOAD, FALL RIVER, COLORADO.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
D. J. Anthony, and M. D. Harvey.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 387-388. 2 ref.

Descriptors: *Bed load, *Bed-load discharge, *Braided streams, *Channel morphology, *Colorado, *Meanders, *Sediment transport, Dam failure, Fall River, Flow rates, Runoff, Seasonal distribution, Thalweg.

A major increase in the amount of bed load supplied to a meandering stream would be expected to cause a shift from meandering to a braided planform. Such an increase occurred after the Lawn Lake Dam failure of July 15, 1982 in Fall River, a meandering stream located in Rocky Mountain National Park. Some reaches of this river now do display a braided pattern, but other reaches appear to have adjusted to the 1000-fold increase in bed load by more subtle, internal adjustments of cross sectional geometry. This channel has shown a remarkable change in cross section geometry during the 1986 snowmelt-fed runoff season. Cross sections measured at high flows in June were typically asymmetric, as expected in a meandering river. The most distinct feature of the velocity components was the helical flow cell that developed in each bend. During the falling stage, the width/depth ratio increased. This shallowing was accompanied by a weakening of the helical flow cell, so that the thalweg was no longer swept clean. In this mobile channel, with its abundant sediment supply, bed topography is a function of the strength of the helical flow cell, which in turn is controlled by discharge level. (See also W91-06570) (Brunone-PTT)
W91-06626

INCISED CHANNEL AND TERRACE FORMATION NEAR MOUNT ST. HELENS, WASHINGTON.
Eton Coll., Windsor (England). Dept. of Geography.
A. D. M. Paine, D. F. Meyer, and S. A. Schumm.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 389-390. 1 fig, 3 ref.

Descriptors: *Channel erosion, *Erosion, *Mount St Helens, *Sediment transport, *Terracing, *Washington, Ash, Avalanches, Avulsion, Bank erosion, Channel morphology, Consolidation sedimentation, Geomorphology, Gully erosion, Slope degradation, Storms, Tributaries, Volcanoes.

Incision of a channel into unconsolidated volcaniclastic deposits at Mount St. Helens illustrates both the interdependence of fluvial system components and the influence of bed and bank materials on erosion rates. Pumping to stabilize the level of Spirit Lake discharged water at a constant rate of 5 cu m/sec between November 1982 and August 1983. The water flowed across and incised a channel into unvegetated ash and debris-avalanche deposits which were locally 50 to 150 m thick. The initial channel was a series of shallow, discontinuous gullies. Rapid erosion occurred close to the pump outlet, and the channel incised 7.1 m during the first 17 days of pumping before an armor developed. Incision was accompanied by some large bank failures of hot pyroclastic-flow deposits which caused phreatic explosions. Impressive flights of terraces were formed during channel incision. Survey data and stratigraphic evidence suggest four causes of terrace formation: channel rejuvenation caused by avulsion; variations in the erodibility of bed and bank material; episodic inputs of sediment from rejuvenated tributaries during storms; and, major bank collapses that temporarily choked the channel. Rate and type of channel incision were controlled by three main factors: erodibility of bed and banks, sediment supply from upstream, and rejuvenation downstream. (See also W91-06570) (Brunone-PTT)
W91-06627

TRIBUTARY ENTRENCHMENT IN RESPONSE TO LOWERED BASE LEVEL BELOW A DAM.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 4C.
W91-06628

PREDICTING CHANNEL RESPONSES TO CHANGING FLOW REGIMES: BEAVER CREEK, ALASKA.
Bureau of Land Management, Lakewood, CO. Denver Service Center.
W. L. Jackson, and B. P. Van Haveren.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 393-394. 1 ref.

Descriptors: *Alaska, *Channel morphology, *Flood frequency, *Flow rates, *Geomorphology, Bankfull stage, Beaver Creek, Bed load, Fisheries, Hydraulic geometry, Meanders, Oxbow lakes, Resource management, Rivers.

Beaver Creek is a north-flowing tributary to the Yukon River in central Alaska. The river is characterized by a gravel and cobble bed, numerous large meanders, oxbows, sloughs, bars, and multiple channels on certain low-sinuosity reaches. In 1986, a project was initiated (1) to determine the minimum quantity of water necessary to protect the outstanding recreation, aesthetic, and fishery values that made Beaver Creek a component of the Wild Rivers System, and (2) to recommend a legal strategy to protect the recommended instream flow regime. Beaver Creek streamflows were synthesized using regional techniques, indirect methods, and direct stream gaging. Hydraulic geometry relationships and indirect discharge rating curves were developed at 17 cross-sections. Relationships between bankfull discharge and bankfull width, depth, velocity, and wetted perimeter were also developed. Beaver Creek Wild River channel slopes range from 0.30 to 0.03 percent and occur in four distinct slope classes. Based upon the bankfull hydraulic geometry relationships and descriptions of channel morphology, uniform 10, 20 and 30% reductions in Beaver Creek's flood-frequency relationship will result in corresponding reductions of 5, 9, and 14% in bankfull width, depth and wetted perimeter. (See also W91-06570) (Brunone-PTT)
W91-06629

DRAINAGE BASIN CHARACTERISTICS AFFECTING SEDIMENT DISCHARGE FROM STEEP MOUNTAIN BASINS.
National Research Center for Disaster Prevention, Sakura (Japan).
T. Mizutani.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 397-398. 1 fig.

Descriptors: *Drainage area, *Erosion, *Flow rates, *Geomorphology, *Japan, *Mountain streams, *Sediment discharge, *Sedimentation, Control dams, Gravity, Rainfall intensity, Sediment transport, Sediment yield, Volcanoes.

Topographical, geological and rainfall factors affecting the rate of sediment discharge from steep mountain basins were investigated by analyzing the sedimentation data in 21 sediment control dams in the Northern Kanto area, central Japan. The most basic topographical factor related to erosion and sediment transport in mountainous regions is slope gradient which determines the component of gravity. By analyzing the sedimentation data in the 21 dams in the period from 1952 to 1966 when only a few small dams were constructed in upper reaches, equations relating mean annual volumetric rate of sedimentation per unit drainage area (Q) to the mean gradient of the basin were derived. Comparing the proportional constants, the rate of sediment yield in the area of young volcanic bodies is about two times that of plutonic rocks. Significant correlations are obtained between Q and drainage density,and between Q and valley bed slope of the upper reach of dams. The maximum 3-hour rainfall intensity gives the greatest effect on sediment yield. (See also W91-06570) (Brunone-PTT)
W91-06631

HYDROLOGICAL REGIME AND FLUVIAL PROCESSES IN BASALTIC MOUNTAINOUS AREAS.
Haifa Univ. (Israel). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06632

DISCHARGE AND SUSPENDED SEDIMENT OF THE UPPER NAN RIVER, NAN PROVINCE, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Watershed Management Div.
W. Jirasuktaveekul, S. Charoensuk, and S. Rouysungnern.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 401.

Descriptors: *Flow rates, *Sediment discharge, *Stream discharge, *Suspended load, *Suspended sediments, *Thailand, *Upper Nan River, Rainfall, Regression analysis, Seasonal variation, Sediment yield.

Discharge and suspended sediment of the upper Nan River, one of four main streams of the Chaopraya, were investigated at four locations southward along the main stream at Chiang Klang, Tha Wangpha, Muang Nan, and Sa stations. The relationships between discharge and rainfall, suspended sediment and rainfall, as well as discharge and suspended sediment, were analyzed. The maximum monthly discharge at Chiang Klang and Sa was recorded in September (169 and 582 cu m/sec) and at Tha Wangpha and Muang Nan in August (356 and 430 cu m/s). The minimum monthly discharge was recorded in March at all points (15.9, 6.2, 21.4, and 32.1 cu m/sec, respectively). Suspended sediment yield at Chiang Klang, Tha Wangpha, Muang Nan,and Sa was 50,000, 140,000, 180,000, and 220,000 tons/year, respectively. The maximum monthly suspended sediment yield at Chang Klang, Tha Wangpha,and Muang Man occurred in August (213,000, 591,000, and 975,000 tons, respectively) but occurred in September at Sa (940,000 tons). The maximum suspended sediment per unit area was 477 tons/sq km at Tha Wangpha, 398 tons/sq km at Muang Nan, 361 tons/sq km at Chiang Klang, and only 258 tons/sq km at Sa. The minimum suspended sediment yield at Chiang Klang was in February (571 tons), at Tha Wangpha and Muang Nan in March (265 and 685 tons), and at Sa in April (1700 tons). Regression analysis indicated that the amount of rainfall had little influence on discharge and suspended sediment. Discharge was found to have the greatest influence on suspended sediment. (See also W91-06570) (Author's abstract)
W91-06633

EFFECTS OF WOODY DEBRIS REMOVAL ON SEDIMENT STORAGE IN A NORTHWEST CALIFORNIA STREAM.
Redwood National Park, Orick, CA.
R. Klein, R. Sonnevil, and D. Short.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 403-404. 1 fig, 2 ref.

Descriptors: *California, *Channel storage, *Debris removal, *Sediment transport, *Stream order, *Woody debris, Accumulation, Aggradation, Channel morphology, Fish migration, Flow rates, Log jam, Model studies, Productivity, Redwood Creek, Sedimentation, Tributaries.

Bridge Creek, a fourth-order tributary to Redwood Creek, drains 30 sq km of forested, mountainous terrain in the Coast Range of northern California. Over 30 cross sections and detailed thalweg and fill terrace surveys through the lower 2.4 km of Bridge Creek, combined with historical information, were utilized to estimate pre-disturbance and post-disturbance stored sediment volumes, as well as annual sediment fluxes since 1984. Presently only one significant woody debris accumulation exists in the study reach. To improve the chances of a fish passage, debris was removed from the top of the log jam in the summer of 1984. Headward cutting through the stored sediments progressed to 370 m upstream of the log jam, and caused a net scour of 930 cu m. Cross sections further upstream, however, indicated a strong trend of aggradation increasing in a downward direction. To estimate sediment loss caused by debris removal from the log jam, a hypothetical volume of aggradation was calculated by extrapolating the trend of net aggradation downstream through the reach which experienced headward cutting. Removal of woody debris from streams draining forested steeplands may have significant and long-lasting effects on channel morphology and subsequent biological productivity, emphasizing the need to approach management of woody debris with caution. A more conservation approach of partial barrier removal warrants consideration. (See also W91-06570) (Brunone-PTT)
W91-06634

STREAM CHANNEL RESPONSE TO THE REMOVAL OF LARGE WOODY DEBRIS, LARRY DAMM CREEK, NORTHWESTERN CALIFORNIA.
California Univ., Santa Barbara. Dept. of Geological Sciences.
A. Macdonald, and E. A. Keller.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 405-406. 4 fig.

Descriptors: *California, *Channel erosion, *Channel morphology, *Debris removal, *Erosion, *Larry Damm Creek, *Sedimentation, *Woody debris, Bedrock, Channel scour, Flow velocity, Resource management, Roughness, Sinuous flow, Thalweg, Tributaries.

The removal of large woody debris (LWD) causes a channel form controlled by the remaining randomly distributed large roughness elements (LRE); these may be bends, exhumed or newly introduced woody debris, or bedrock outcrops. In Larry Damm Creek in California, the net result of removal of large woody debris (LWD) accumulations has been the evolution of the channel pattern towards a more 'alluvial' state, stabilized by bends at bedrock outcrops and woody-debris-defended banks. To examine the mechanisms by which LWD controls local energy expenditure,and consequent patterns of water depth, velocity, and sediment storage, 70 cu m of LWD were removed from Larry Damm Creek, a third-order tributary in the Redwood Creek Watershed. The most notable effects of debris removal were (1) the local increase in water velocity through the vicinity of the debris jams at measured discharges as a result of displaced channel roughness and decreased sinuosity of the low flow thalweg, (2) approximately 100 cu m of sediment that was entrained solely from within the affected reach in the first year after debris removal, and (3) the creation or deepening of pools at bends above and below the two debris jams at the expense of numerous scour pools within the jam. A sediment routing model based on measured scour and fill was used to describe the movement of fine-grained, debris-stored sediment into new storage sites. Channel morphology has stabilized around the flowing LRE's: major bends in the channel above and below the former location of the debris jams, sediment deposits associated with these bends, and some of the original debris-stored sediment that was stabilized with vegetation prior to channel disturbance. (See also W91-06570) (Brunone-PTT)
W91-06635

SLACKWATER HABITAT IN TORRENT-IMPACTED STREAMS.
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 2E.
W91-06636

SEDIMENT TRANSPORT AND DEPOSITION ZONES IN BRAIDED STREAMS.
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
K. L. Prestegaard.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 411-412.

Descriptors: *Alluvial channels, *Braided streams, *Channel morphology, *East Rosebud River, *Montana, *Sediment transport, *Sedimentation, Bank erosion, Bed load, Deposition, Gravel, Particle size, Sand, Shear stress.

Recent research on sediment transport in heterogeneous gravel-bed streams has shown that coarse surface particles can regulate the mobility of finer subsurface materials. Transport and deposition processes were examined during high flow periods for 5 years in the East Rosebud River, Montana. Three types of data were collected in a 1.5 km long reach. Channel cross sections, surface and subsurface particle sizes, and water surface slope were measured over the entire reach; sediment transport rates and materials, discharge and local shear stress were measured at 22 cross sections; and marked bed material was monitored to examine travel distances of particles and depositional events. Deposition resulted from replacement and deposition. Bedload sand moves as subsurface sand that is regulated by surface gravels and throughput sand which moves in narrow zones or strings but can influence gravel transport and deposition at high shear stresses. Significant sorting occurs during transport and deposition events. In the East Rosebud River, one population of sand moves as subsurface material and its mobility is limited by the coarse surface material. A population of surface sand, derived primarily from bank erosion, moves in narrow sand zones over the gravel. Surface throughput sand accounts for a large part of the sand flux from the system. The depositional mechanisms and behavior of sand populations in this river both attest to the complexity of transport, sorting and deposition of sediment in braided streams with heterogeneous sediment sizes. (See also W91-06570) (Brunone-PTT)
W91-06638

CHANGES IN SEDIMENT STORAGE OVER TIME ON A COASTAL CALIFORNIA RIVER.
Monterey Peninsula Water Pollution Control Agency, CA.
W. V. G. Matthews, and G. M. Kondolf.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 413-414. 1 fig, 4 ref.

Descriptors: *California, *Channel storage, *Coastal streams, *Dam effects, *Sediment transport, Bank erosion, Carmel River, Channel morphology, Channel stability, Economic aspects, Erosion, Gages, History, Suspended sediments.

The role of sediment storage has been recognized in sediment budgets for many settings. Sediment supply from the rugged upper half of the Carmel River basin was reduced in 1921 by the construction of the San Clemente Dam. The economic and environmental problems resulting from the channel instability prompted a study of sediment transport on the mainstream and tributaries below the dam. Values computed for the Robles gage are based on a poorly defined sediment rating curve and are believed to underestimate substantially the amount of suspended sediment transported over the dam. The difference between the total of inputs and the output measured at the lower gage can be attributed to in-channel storage changes. In 1980, bank erosion transferred sediment from storage in the flood terrace to in-channel sites. In subsequent years, there was a net withdrawal of a sediment from in-channel storage, consistent with post-1980 incision observed at many cross sections. (See also W91-06570) (Brunone-PTT)
W91-06639

GEOMORPHIC AND HYDROLOGIC CONDITIONS FOR COLD POOL FORMATION ON REDWOOD CREEK, CALIFORNIA.
Redwood National Park, Arcata, CA.
For primary bibliographic entry see Field 2E.
W91-06640

MAGNITUDE, CAUSE AND BASIN RESPONSE TO FLUVIAL EROSION, REDWOOD CREEK BASIN, NORTHERN CALIFORNIA.
Redwood National Park, Arcata, CA.
D. K. Hagans, and W. E. Weaver.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 419-428. 1 fig, 2 tab, 19 ref.

Descriptors: *Channel erosion, *Erosion, *Geomorphology, *Gully erosion, *Redwood Creek Basin, *Sediment transport, Bank erosion, Channel morphology, Drainage effects, Mass wasting, Prediction, Roads, Sedimentation, Slope degradation, Slopes, Storms.

Detailed erosion inventories and geomorphic mapping document the magnitude and causes of fluvial sediment production from hillslopes in the 197 sq km lower Redwood Creek basin. Sediment production from various fluvial erosion processes (gully erosion, 37%; washed out stream crossings,

7%; and surface erosion from bare soil areas, 4%) is nearly equal in volume to material derived from mass movement processes (52%). The leading cause of gully erosion is the diversion of streamflow at logging road and skid trail stream crossings. A simple predictive methodology, based principally on road gradient, successfully identifies stream crossings with a high potential for stream diversion (DP). Undersized culverts, infrequent culvert maintenance and the occurrence of high DP stream crossings have combined with infrequent, severe winter storms to trigger widespread gully erosion. Long-term effects of fluvial erosion include increased hillslope drainage density, enlarged stream channels and downstream effects including bank erosion and decreased pool frequency. (See also W91-06570) (Author's abstract)
W91-06641

RESIDENCE TIMES OF CHANNEL-STORED SEDIMENT IN REDWOOD CREEK, NORTHWESTERN CALIFORNIA.
Redwood National Park, Arcata, CA.
M. A. Madej.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 429-438. 4 fig, 1 tab, 20 ref.

Descriptors: *California, *Channel storage, *Redwood Creek, *Residence time, *Sediment transport, *Sedimentation, Aggradation, Detritus, Flooding, Tributaries.

Floods in 1964, 1972 and 1975 resulted in streambed aggradation in Redwood Creek and its tributaries. Sixty to 100% of the sediment stored in steep, low-order tributaries was transported out of the channels in five to ten years, except where trapped by debris jams. In the mainstem of Redwood Creek, recovery after aggradation varies from 0 to 70%, depending on the 'activity level' of the sediment. Calculated residence times for the remaining sediment range from decades for active and semi-active sediment to centuries for inactive and stable sediment. Much of the recovery of Redwood Creek and its tributaries after major flooding and associated aggradation occurred within 10 years of the event. In the mainstem of Redwood Creek, sediment stored in active and semi-active categories is easily mobilized and has a residence time of ten to fifty years per reach. The calculated residence time of the remaining sediment exceeds the recurrence interval of the floods which deposited it. In contrast, steep, small tributaries of Redwood Creek are more efficient sediment transporters, and they flush themselves clean of sediment rapidly. The residence time of sediment upstream of debris jams is dependent on the stability of the jam. (See also W91-06570) (Brunone-PTT)
W91-06642

BANKFULL DISCHARGE AND SEDIMENT TRANSPORT IN NORTHWESTERN CALIFORNIA.
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2E.
W91-06643

RESPONSE OF DRY CREEK, CALIFORNIA, TO LAND USE CHANGE, GRAVEL MINING AND DAM CLOSURE.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 4C.
W91-06644

SEDIMENT PRODUCTION AND TRANSPORT IN THE PHEWA VALLEY, NEPAL.
Land Capability Consultants Ltd., Cambridge (England).
W. J. H. Ramsay.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 461-472. 3 fig, 2 tab, 28 ref.

Descriptors: *Erosion, *Nepal, *Phewa Valley, *Sediment transport, *Sedimentation, Landslides, Mass wasting, Seasonal distribution, Sediment yield, Slopes, Water level.

A reconnaissance survey of hillslope and fluvial processes in the Phewa Valley in central Nepal indicates seasonally high levels of sediment production, principally due to mass movement activity, high sediment delivery ratios, and a sediment yield downstream reduced by energy limitations in the fluvial transport system. Surface lowering by landsliding is approximately 2 to 3 mm/year. Locally, surface erosion on overgrazed pasture reaches 5-6 mm/year. Although small debris slides are common, 90% of all material mobilized by mass wasting originates in large failures with a mean estimated age of 24 years. (See also W91-06570) (Author's abstract)
W91-06645

EROSION AND SEDIMENTATION CAUSED BY TYPHOONS IN 1982 IN THE AMAHATA RIVER BASIN, JAPAN.
Tsukuba Univ. (Japan). Inst. of Geoscience.
M. Aniya.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 473-482. 6 fig, 6 ref.

Descriptors: *Channel morphology, *Erosion, *Japan, *Landslides, *Sedimentation, *Storms, *Typhoons, Amahata River Basin, Channel erosion, Denudation, Detritus, Disasters, Recovery, Slope degradation, Tributaries.

Landsliding, debris discharge and sedimentation caused by two typhoons in 1982 were investigated in the Amhata River basin, 130 km west of Tokyo, Japan. Landsliding removed surface materials corresponding to an overall denudation of 8.24 mm. In the valley of the Inamata River, the largest tributary, changes were particularly devastating, for a total of 212,300 cu m was deposited on the channel bed, raising the bed in one place by about 17 m. Rapid erosion ensued and the channel bed has been recovering the former profile. By October 1986, the amount of incision was several meters. The rate of erosion had become progressively slower, making the recovery also slower. Probably before gaining the former profile, another devastating change will occur which will be followed by a different recovery process. Thus the channel profile dynamically changes. (See also W91-06570) (Author's abstract)
W91-06646

EROSION PROCESS IN THE MIDDLE AND UPPER REACHES OF THE YANGZI RIVER.
Chengdu Inst. of Geography (China).
J. Li, and K. Cheng.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 483-487. 1 fig, 5 ref.

Descriptors: *Changjiang River, *Channel erosion, *Erosion, *Silt load, Debris flow, Erosion control, Gully erosion, Land use, Reservoir capacity, Reservoir silting, Tributaries, Watersheds, Yellow River.

In the Yangzi River, the largest river in China, erosion is rapidly progressing in the middle and upper portions of the basin. The present silt discharge of the Yangzi is twice that observed in 1958. The total volume of silt transported annually is around 500 million tons, nearly one-third the silt volume of the Yellow River. In 1949, the surface area of Dongting Lake, in Hubei Province, was 4350 sq km; in 1977, the surface area was only 2640 sq km. This decrease has reduced the reservoir capacity to control floods in the Yangzi River. About 27 million tons of solid materials are carried down the Yangzi River into the lake each year. Numerous debris-flow gullies have developed in the middle and upper reaches of the Yangzi River, especially in tributaries. The development of gullies that produce debris flows is one of the main reasons for silting in of the basin. The annual erosion rate in some debris-flow watersheds reaches 8500 to 13,000 cu m/sq km. The area is undergoing rapid development and an increase in human population. The most meaningful measure for improving erosion conditions in the basin is to reinstate the ecological environment of the upper and middle reaches of the Yangzi River. At the same time, erosion prevention measures should be incorporated into the engineering projects that are under construction. (See also W91-06570) (Brunone-PTT)
W91-06647

LANDSLIDE EROSION IN CENTRAL SANTA CRUZ MOUNTAINS, CALIFORNIA, USA.
Geological Survey, Menlo Park, CA.
G. F. Wieczorek.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 489-498. 3 fig, 5 tab, 14 ref.

Descriptors: *California, *Erosion, *Geomorphology, *Landslides, *Santa Cruz Mountains, Climates, History, Rainfall, Seasonal variation, Slope degradation, Storms.

Geomorphic work performed by landsliding in an 11.6 sq km area near La Honda, in the central Santa Cruz Mountains of northern California, was estimated from an inventory of 277 active landslides compiled over a period of 12 years (1974-1986). Landslides were categorized according to their dominant type of movement, allowing comparison of erosion caused by different slope processes and triggering events. Although relatively small debris flows were the most frequent type of landslide, the majority of geomorphic work was done by a relatively few large slumps, block slides, and earth flows. High seasonal rainfall affected the geomorphic work more than individual intense storms did. Earthquake-induced landslides have done only a minor amount of work compared to climatically induced landslides within the recent historic past. (See also W91-06570) (Author's abstract)
W91-06648

FORESTRY AND SEDIMENT YIELDS IN UPLAND SCOTLAND.
Stirling Univ. (Scotland). Dept. of Environmental Science.
R. Ferguson, and T. Stott.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 499-500. 2 ref.

Descriptors: *Erosion, *Forestry, *Logging, *Scotland, *Sediment yield, *Suspended sediments, *Watersheds, Bank erosion, Bed load, Particle size, Rainfall, Road construction, Slopes, Snowfall, Streamflow, Tributaries.

Paired catchments, each about 700 sq km in area and 700 m in height and with rainfall and snowfall > 2000 mm/year, were instrumented in 1982, to study the effects of upland land use on water quantity and quality at Balquhidder in the Scottish Highlands. Mainstream outputs were monitored for streamflow and suspended sediment levels. Results show that (a) suspended sediment output from the forested basin varied more closely and sensitively with streamflow and was about three times higher in total, suggesting greater availability of fine sediment; (b) tributary streams provided far more sediment than hillslopes or mainstream bank erosion; and (c) less than 5% of total sediment output was bedload. Following disturbance, there does not seem to have been a dramatic increase in sediment yield. Bedload yield has increased in some tributaries but not all; suspended sediment yield has been most disturbed by road construction. (See also W91-06570) (Brunone-PTT)
W91-06649

LAND USE, EROSION RATES, AND RESERVOIR SEDIMENTATION IN A COASTAL ECUADORIAN WATERSHED.
New Mexico State Engineer Office, Santa Fe.
W. M. Fleming.

IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 501-502.

Descriptors: *Ecuador, *Erosion, *Land use, *Reservoirs, *Sedimentation, Agriculture, Conservation, Erosion control, Eutrophication, Forests, Poza Honda, Reforestation, Resource management, Soil conservation, Watershed management.

The Poza Honda watershed, located 200 km southwest of Quito, Ecuador, has severe problems with sedimentation and eutrophication because of the tropical climate and intensive land use in critical areas. Slope, soil stability, and shoreline proximity are three key variables in determining limits of permissible use. Field evidence of erosion problems demonstrated that slopes greater than 65% should be classified as 'protection forest' (11% of the watershed area). Slopes of 45 to 65% on stable soils or slopes of 35 to 45% on unstable soils were targeted for 'production forest' (16% of the watershed area). Land with stable soil and slopes of 35 to 45% or any agricultural land with slopes of 25 to 35% were designated as 'grazing/cultivated land needing conservation measures' (31% of the watershed). Forty percent of the watershed has slopes less than 25% and does not require restrictions on agricultural development. Critical river and reservoir shoreline areas requiring the designation of 'protection forest' comprise 3% of the watershed. A map overlay comparison of 'permissible' and actual land uses shows that 505 ha require reforestation for protection and 870 ha need tree plantings for production. An additional 255 ha should be reforested to protect the shorelines of rivers and the reservoir. (See also W91-06570) (Brunone-PTT)
W91-06650

RESPONSE OF A NORTHERN CALIFORNIA COASTAL DRAINAGE BASIN TO LAND USE DISTURBANCE.
Humboldt State Univ., Arcata, CA. Dept. of Watershed Management.
D. A. Short.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 503-504. 1 ref.

Descriptors: *California, *Erosion, *Landslides, *Logging, *Sediment transport, *Slope degradation, *Storms, Aggradation, Channel storage, Cuneo Creek, Elevation, Photography, Revegetation, Riparian vegetation.

Major regional storms impacted the Cuneo Creek drainage basin, located in the Coast Ranges of northern California, in 1955, 1960, and 1964. Analysis of historic air photos shows the response of the basin to the major storm events and the simultaneous progression of logging in the basin. Increases in size and number of landslides are evident, and channel widths in lower Cuneo Creek increased from tens to hundreds of meters. Bridge construction records and ground level photographs taken at the bridge crossing Cuneo Creek near its confluence with Bull Creek reveal a history of extreme aggradation. Downcutting at the bridge site is dependent on the bed elevation of Bull Creek at its confluence with Cuneo Creek. Decreasing contributions of sediment from source areas since the mid 1960's have allowed sediment stored in the channel of Cuneo Creek to be transported downstream into Bull Creek. The rate of change in the volume of stored sediment can be used as an indicator of basin recovery rate. Air photo analysis of the upper basin reveals progressive revegetation of the hillslopes, a diminishing number of new hillslope failures, decreasing growth of active landslides, and the reestablishment of riparian vegetation along the upper reaches of Cuneo Creek. Processes acting further downstream outside of the local basin are providing significant control on sediment transport out of the Cuneo Creek channel. (See also W91-06570) (Brunone-PTT)
W91-06651

CONTROLS ON THE RELATION OF STREAMSIDE LANDSLIDING TO CHANNEL SEDIMENT STORAGE IN A REGION OF ACTIVE UPLIFT.
Western Washington Univ., Bellingham. Dept. of Geology.
H. M. Kelsey.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 505-506.

Descriptors: *Channel morphology, *Channel storage, *Erosion, *Geomorphology, *Landslides, *Sediment sources, *Storms, Channel erosion, Energy costs, Particle size, Sandstones, Shear stress, Slopes, Streams.

Sites of streamside landslides are removed from sites of sediment storage in northern California Coast Range stream channels that drain the Franciscan Assemblage. Infrequent climatic events are the most important control on initial delivery of sediment from hillslopes to channels because streamside debris slides are storm-induced. The time rate of energy expenditure by the stream is a measure of relative sediment transport capacity between reaches. Values of stream power per unit bed area are relatively high for erosional reaches (sites of streamside landsliding) and relatively low for depositional reaches (sites of channel-sediment storage). Geologic mapping indicates that active channel width often is closely controlled by lithologic variation. Narrow channels are generally confined to competent sandstones and wider channels are generally in fine-grained sheared sediments and in schist. The role of rock type on hillslope-channel interactions is that (1) competent sandstones form narrow bedrock valleys through the combination of downcutting and streamside debris sliding, and (2) wider channels where competent rocks are generally absent and streamside debris sliding is not prevalent store sediment for longer periods of time than in the narrow reaches. (See also W91-06570) (Brunone-PTT)
W91-06652

ROLE OF MAGNETIC MEASUREMENTS IN THE DEVELOPMENT OF A RIVER BASIN EROSIONAL HISTORY.
California Univ., Davis. Dept. of Geology.
For primary bibliographic entry see Field 7B.
W91-06653

FIELD METHODS USED FOR MONITORING EROSION AND SEDIMENTATION PROCESSES IN STEEPLANDS OF NORTHWESTERN CALIFORNIA, USA.
Redwood National Park, Arcata, CA.
For primary bibliographic entry see Field 7B.
W91-06654

EROSION, TRANSPORT AND DEPOSITION PROCESSES.
Proceedings of a Workshop held at Jerusalem, Israel, March-April 1987. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. 203p. Edited by D. E. Walling, A. Yair, and S. Berkowicz.

Descriptors: *Deposition, *Erosion, *Sediment transport, *Workshops, Arid lands, Computer models, Conferences, Geomorphology, Model studies, Runoff, Sedimentation, Semiarid lands.

The 13 papers presented in this volume represent one outcome of the International Workshop on Erosion, Transport and Deposition Processes. The Workshop was a joint activity of the Commission on Measurement, Theory and Application in Geomorphology (COMTAG) of the International Geographical Union, and the International Commission on Continental Erosion (ICCE) of the International Association of Hydrological Sciences. It represents the first formal collaboration between these two groups of geomorphologists and hydrologists, although there have been close contacts in the past. Discussions in the lecture hall, as well as in the field, reflected a growing feeling among hydrologists and geomorphologists that, over the past two decades, computer modelling of runoff and erosion processes has been losing much of the necessary basis demonstrable by field relationships. Real world information is essential to enable an understanding of natural processes scientifically; often, if possible, with the aid of computer modelling, but sometimes also without it. This order of precedence, irrespective of the methods used, is exemplified in the diverse papers contained in this volume which are expected to narrow the gap between theory and modelling of erosion and sedimentation processes, and their actual behavior in the real world. (See W91-06718 thru W91-06730) (Lantz-PTT)
W91-06717

SEDIMENTARY DATA BASE: AN APPRAISAL OF LAKE AND RESERVOIR SEDIMENT BASED STUDIES OF SEDIMENT YIELD.
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
I. D. L. Foster, J. A. Dearing, R. Grew, and K. Orend.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 19-43, 7 fig, 2 tab, 96 ref.

Descriptors: *Lake sediments, *Reservoirs, *Sediment yield, *Sedimentation, Data interpretation, Databases, Lake morphology, Mathematical studies, Sediment load.

Direct monitoring provides a highly resolved database with which to study short-term process response systems, while sedimentary information, based for example on stratigraphic and palaeoecological studies of river terraces and valley deposits, provide palaeohydrological information covering much of the Holocene period. Medium term changes, over decades and centuries, are much less well represented in the hydrological literature for two major reasons. First, monitoring programs have not been established for a sufficient period of time to detail changes over these timescales and second, sedimentary features in river valleys are rarely deposited continuously over these timescales. These sediments do not preserve material of use for highly resolved dating and the relationships between sediment yield and deposition in such situations is complex. One solution to this problem is to analyze the accumulating sediments in natural lakes and reservoirs in order to estimate sediment yield changes through time. Within this report, six major objectives are identified for monitoring networks. These objectives are: (1) to aid in the understanding of natural processes and how process rates are influenced by human activity and climate; (2) to detect trends and periodicities in hydrologic time series; (3) to formulate hypotheses for possible causes of change in the system; (4) to measure process rates under natural and altered conditions; (5) to describe qualitatively and measure quantitatively the effects of human activity on the environment; and (6) to aid prediction in the management of land and water resources in the future. (See also W91-06717) (Lantz-PTT)
W91-06719

EMPIRICAL RELATIONSHIPS FOR THE TRANSPORT CAPACITY OF OVERLAND FLOW.
Katholieke Univ. Leuven (Belgium). Lab. voor Experimentele Geomorfologie.
G. Govers.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 45-63, 10 fig, 2 tab, 46 ref.

Descriptors: *Overland flow, *Sediment transport, Erosion, Flow profiles, Mathematical studies, Sand, Sediment load, Sedimentation, Silt, Vegetation.

Experiments were carried out with 5 materials, varying from silt to coarse sand, using a wide range of discharges and slopes, in a flume with a plane bed, to determine the transport capacity of overland flow. The experiments provide the neces-

sary data to establish highly correlated relationships between the sediment transport capacity of the flow and different hydraulic parameters, which are a necessary element of all physically based erosion models. Some important characteristics of these relationships are identified which include: the limited range of validity of individual relationships, and the apparent lack of connection between initiation of sediment motion and sediment transport. Some relationships can also be applied to rough surfaces and to surfaces with vegetative cover. It is believed that the proposed set of empirical relationships can be of use in the study of many aspects of soil erosion and deposition. (See also W91-06717) (Author's abstract)
W91-06720

EVOLUTION OF AN ANTHROPOGENIC DESERT GULLY SYSTEM.
Oxford Polytechnic (England). Dept. of Geography.
M. J. Haigh.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 65-77, 5 fig, 26 ref.

Descriptors: *Arroyos, *Deserts, *Gully erosion, *Model studies, Aggradation, Arid lands, Arizona, Erosion, Greenes Canal, Gullies, Irrigation, Mathematical models, Overland flow, Seepage.

Studies of an unusual quasi-stationary desert gully permit the description of a system attractor which may be inherent, if rarely physically expressed, in many gully systems. Measurements made in a desert gully system (controlled by the seepage of irrigation waters toward a stable base level) suggest a character for the attractor's equilibrium manifold. This is modelled mathematically as an hysteresis or limit cycle in phase space. Overall, the phenomenon is seen to belong to a kind of hierarchical process associated with the Scheidegger 'principle of instability/saturation effect'. It reflects a dynamic balance between two hierarchical levels inside a single system. The system includes a singularity which is an example of an hierarchical jump caused by the reintegration of a self-assertive holon. (See also W91-06717) (Author's abstract)
W91-06721

RELATIONSHIP BETWEEN SEDIMENT DELIVERY RATIO AND STREAM ORDER: A ROMANIAN CASE STUDY.
Statiunea de Cercetari Stejarul, Piatra-Neamt (Romania). Geomorphology Lab.
I. Ichim.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 79-86, 3 fig, 1 tab, 11 ref.

Descriptors: *Geomorphology, *Romania, *Sediment transport, *Stream classification, Drainage area, Erosion, Geohydrology, Mathematical studies, Moldavia, Overland flow, Rock mechanics, Sediment load, Sedimentation, Surface runoff.

An investigation of sediment delivery ratios in three regions of Romania (Moldavian Tableland, Subcarpathians and Flysch Mountains) shows an inverse relationship between sediment delivery ratio and drainage basin order (Strahler's system). However, these relationships vary in their precise form. There are two main controlling factors: rock erodibility and runoff regime. When the rocks are easily eroded and the small headwater catchments evidence runoff of a torrential character, the sediment delivery ratio decreases markedly with an increase in river network order. This is the case in the Moldavian Tableland, where the foothills are a zone of active colluviation. When rocks are easily eroded, and runoff is greater, high sediment delivery ratios exist; this is the case in the Subcarpathians. When the rocks are resistant to erosion and the runoff is high, the relationship between sediment delivery ratio and drainage basin order exhibits a more moderate slope, as shown by the Flysch Mountains. (See also W91-06717) (Author's abstract)
W91-06722

SIMULATION MODEL FOR DESERT RUNOFF AND EROSION.
Leeds Univ. (England). School of Geography.
For primary bibliographic entry see Field 2E.
W91-06723

TOWARDS A DYNAMIC MODEL OF GULLY GROWTH.
Bristol Univ. (England). Dept. of Geography.
A. C. Kemp.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 121-134, 7 fig, 18 ref.

Descriptors: *Drainage systems, *Erosion, *Gullies, *Gully erosion, *Model studies, *Sediment transport, *Spain, Flood routing, Hydrologic models, Mathematical models, Overland flow, Semiarid lands, Slopes.

Headward migration of gullies around the margins of drainage networks may be a major factor in the increased sediment yields observed in semi-arid southeast Spain. Although many processes have been cited, the precise nature of this gully extension and bifurcation is not known. A gully which is migrating into a hillslope may be defined way its morphological dynamics. A digital model has been formulated whereby the governing process is erosion by overland flow. Using finite techniques, the continuous phenomena may be approximated with discrete functions. The model grid is set up by defining strip catchments which are bounded by orthogonal flowlines. Overland flow is then routed downslope kinematically, assuming gravity and friction as the controlling forces. Sediment detachment, transport and deposition are estimated using a Musgrave-type approach which incorporates an interaction term. This compares the energy required to carry sediment already in transport with the total capacity of the flow to do work. The consequent change in the slope surface is the expressed by the migration of the contours alone the flow lines. In this manner, the effects of hillslope and gully geometry on gully development may be explored. The simulations indicate a critical balance between a linear propagation of the erosion headward, and a diffusion laterally of this impulse. A possible mechanism for the bifurcation phenomenon is identified within this balance. (See also W91-06717) (Author's abstract)
W91-06725

DYNAMICS OF GULLY HEAD RECESSION IN A SAVANNA ENVIRONMENT.
Bayero Univ., Kano (Nigeria). Dept. of Geography.
E. A. Olofin.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 135-144, 3 fig, 3 tab, 16 ref.

Descriptors: *Erosion, *Gully erosion, *Nigeria, *Savannas, Erosion rates, Field tests, Gullies, Runoff, Seasonal variation, Sediment transport.

Field measurements have been carried out to investigate the process and rates of gully head recession in a tropical wet and dry location in Nigeria, over three wet seasons. A combination of gully wall erosion processes and gully floor basal sapping was found to enhance headscarp recession and gully widening through a cycle of undercutting, collapse, and removal of collapsed material. The average recession rate was 2.32 m/yr; the fastest recession was 4.7 m/yr. These rates amount to 8.6 cu m/yr and 20.4 cu m/yr respectively, yielding an average loss of 41 cu m/ha. The major on-site factors accounting for these results include the amount of runoff arriving at each gully head, the texture and structure of the aeolian material into which gully heads are cut, and the absence of land management in the gullied zone. To stabilize the gullies, the recession cycle must be broken. (See also W91-06717) (Author's abstract)
W91-06726

CONDITIONS FOR THE EVACUATION OF ROCK FRAGMENTS FROM CULTIVATED UPLAND AREAS DURING RAINSTORMS.
Katholieke Univ. Leuven (Belgium). Lab. voor Experimentele Geomorfologie.
J. W. A. Poesen.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 145-160, 9 fig, 1 tab, 31 ref.

Descriptors: *Cultivated lands, *Erosion, *Rainstorms, *Rocks, *Soil erosion, Gully erosion, Mathematical studies, Peak flow, Rainfall, Rill erosion, Rills, Slopes, Surface runoff.

Most studies dealing with the erosion of stony soils have treated rock fragments at the soil surface as mulch elements. This investigation considers rock fragments on upland areas as erodible particles. Processes capable of moving rock fragments are, the hydraulic conditions necessary to start rock fragments moving on slopes, and the factors that determine displacement distances of rock fragments, are investigated. Monitoring the movement of colored rock fragments revealed that during a moderate rainfall event, rock fragments up to 9.0 cm in diameter travelled downslope by rill flow. The competence of interrill flow was about one order of magnitude smaller. Incipient motion conditions for rock fragments lying on a rill bed coincide with a critical Shields entrainment parameter of 0.012 rather than with 0.06. Rock fragment transport distance was controlled more by fragment size than by fragment shape, and correlated better with rill bed slope than with peak rill flow discharge. (See also W91-06717) (Lantz-PTT)
W91-06727

SEASONAL VARIATIONS OF RUNOFF RATES FROM FIELD PLOTS IN THE FEDERAL REPUBLIC OF GERMANY AND IN HUNGARY DURING DRY YEARS.
Trier Univ. (Germany, F.R.). Angewandte Physische Geographie, Fach Fernerkundung.
For primary bibliographic entry see Field 2E.
W91-06728

NEW DEVELOPMENTS IN MEASURING BED LOAD BY THE MAGNETIC TRACER TECHNIQUE.
Freie Univ. Berlin (Germany, F.R.). Inst. fuer Physische Geographie.
For primary bibliographic entry see Field 7B.
W91-06729

SOME APPLICATIONS OF CAESIUM-137 IN THE STUDY OF EROSION, TRANSPORT AND DEPOSITION.
Exeter Univ. (England). Dept. of Geography.
D. E. Walling, and S. B. Bradley.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 179-203, 11 fig, 5 tab, 43 ref.

Descriptors: *Cesium radioisotopes, *Erosion, *Radioactive tracers, *Sediment transport, *Tracers, Cultivated lands, England, Geomorphology, Sediment yield, Sedimentation, Slopes, Soil erosion.

137-Cesium, a radionuclide originating as fallout generated by the atmospheric testing of nuclear weapons, can provide the geomorphologist with a valuable tracer for investigating the movement of sediment through the fluvial system. Three examples of possible applications drawn from the work of the authors in Devon, England, are presented in this report. They involve the use of 137-Cs for: (1) fingerprinting suspended sediment sources; (2) investigating patterns of soil erosion and sediment delivery of cultivated hillslopes; and (3) elucidating rates and patterns of flood plain deposition. (See also W91-06717) (Author's abstract)
W91-06730

MACROPHYTE INFLUENCES ON THE ZONATION OF SEDIMENT ACCRETION AND COMPOSITION IN A NORTH-TEMPERATE RESERVOIR.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
W. F. James, and J. W. Barko.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 2, p 129-142, December 1990. 4 fig, 3 tab, 30 ref.

Descriptors: *Aquatic plants, *Limnology, *Reservoir sediments, *Reservoirs, *Sediment distribution, *Sedimentation, *Sediments, *Wisconsin, Eau Galle Reservoir, Littoral zone, Macrophytes, Seasonal variation, Sediment analysis, Vegetation.

Sediment accretion and composition were examined in vegetated and nonvegetated regions across all depths in Eau Galle Reservoir, Wisconsin. Within riverine areas, delta formation was observed. In the lacustrine area of reservoir, both sediment accretion and moisture content decreased, while sediment density increased, along a gradient of decreasing depth between 9 and 2.5 m. However, accretion again increased at shallower depths (<2.5 m) occupied by submersed macrophytes, Based on differences in sediment accretion and composition, four zones of sediment accretion were distinguished in the lacustrine area: an accumulation zone (>6 m), a transport zone (3.5-6 m), an erosional zone (2.5-3.5 m), and a vegetated littoral zone (<2.5 m). Low density sediments with relatively high organic matter and nutrient concentrations were found in both the littoral and accumulation zones, while high density sediments with low organic matter and nutrient concentrations were found in the erosional zone. Dispersion of sediment from pans placed in the littoral zone was greatest during vernal mixing, when macrophyte biomass was low. Sediment dispersion decreased substantially as macrophytes grew, and remained low during autumnal overturn, when macrophyte standing crop was near peak biomass. Sediment dispersion was high throughout the study in the nonvegetated, erosional zone. Marked differences in sediment composition between the littoral erosional zones, and the occurrence of high rates of sediment accretion in the littoral zone, suggest that submersed macrophytes have been influential in both reducing sediment erosion and promoting sediment accretion in the shallow regions of Eau Galle Reservoir. (Author's abstract)
W91-06759

FINE-GRAINED SEDIMENT TRANSPORT AND SORTING BY TIDAL EXCHANGE IN XIANGSHAN BAY, ZHEJIANG, CHINA.
National Bureau of Oceanography, Hangzhou (China). Second Inst. of Oceanography.
For primary bibliographic entry see Field 2L.
W91-06767

RESUSPENSION IN THE KATTEGAT: IMPACT OF VARIATION IN WIND CLIMATE AND FISHERY.
Uppsala Univ. (Sweden). Naturgeografiska Inst.
For primary bibliographic entry see Field 2L.
W91-06772

RAPID FORMATION OF LARGE COASTAL SAND BODIES AFTER EMPLACEMENT OF MAGDALENA RIVER JETTIES, NORTHERN COLOMBIA.
Instituto Nacional de Investigaciones Geologico-Mineras, Bogota (Colombia).
J. O. Martinez, O. H. Pilkey, and W. J. Neal.
Environmental Geology and Water Sciences EGWSEI, Vol. 16, No. 3, p 187-194, November/December 1990. 8 fig, 10 ref.

Descriptors: *Colombia, *Deltas, *Jetties, *River sediments, *River systems, *Sandspits, *Sediment discharge, *Sediment transport, Accretion, Beach erosion, Beaches, Channels, Coastal zone management, Ecological effects, Economic aspects, Erosion, Future planning, Sandbars, Structural engineering, Wave refraction, Waves.

The Magdalena River is noted for its high discharge of river sediment and its importance as the sediment source for a large delta complex and downdrift coastal sand bodies. The emplacement of jetties, completed in 1935 to stabilize the river mouth, contributed to major changes in the downstream coastal sand bodies. The western delta front retreated an average 65 m/yr. Puerto Colombia spit detached and migrated toward Puerto Colombia at rates of 230-430 m/yr, ultimately running into the town's quay and port facility. Galerazamba spit alternately elongated and shortened over the short term, leading to the destruction or damage of coastal town sites. Isla Cascajo acted as a significant sand trap with nearly 12 km2 of accretion over a 47-year period. Sand is now bypassing the tombolo, and the accretion zone continues migrating southwest. The small Punta Canaos spit also has shown significant accretion since 1974. The changes imply high rates of sediment transport. Furthermore, their growth is probably dependent on jetty-caused alterations of wave patterns, causing remobilization of shelf sands as well as delta-derived sand. Understanding sand body evolution and behavior is important to future development of the northern Colombia coast. Placement of port facilities, recreational beaches, tourist villages, and related support facilities on these sand bodies will require significant planning. (Author's abstract)
W91-06800

MORPHOLOGY, SEDIMENTOLOGY, AND TIDAL CHANNEL PROCESSES ON A HIGH-TIDE-RANGE MUDFLAT, WEST COAST OF SOUTH KOREA.
North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences.
For primary bibliographic entry see Field 2L.
W91-06816

INTERNAL HYDRAULICS OF A SEDIMENT-STRATIFIED CHANNEL FLOW.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W91-06817

TRANSPORT AND SEDIMENT ACCUMULATION OF PB-210 AND CS-137 IN TWO SOUTHEAST ALASKAN FJORDS.
Alaska Univ., Fairbanks. Inst. of Marine Science.
S. F. Sugai.
Estuaries ESTUDO, Vol. 13, No. 4, p 380-392, December, 1990. 6 fig, 3 tab, 40 ref. NOAA, Department of Commerce, Grant No. NA18AA-D-9, Proj. No. E/70-06.

Descriptors: *Alaska, *Cesium radioisotopes, *Erosion, *Estuarine sediments, *Fjords, *Lead radioisotopes, *Radioisotopes, *Sedimentation, *Tracers, Boca de Quadra Fjord, Cores, Estuaries, Radiochemical analysis, Sediment analysis, Sediment distribution, Sediment sampling, Smeaton Bay.

Sediment profiles of Pb-210 and Cs-137 in cores collected at increasing distances from the heads of Smeaton Bay and Boca de Quadra fjords indicate that watersheds influence the inventories of radioisotopes present and that the steep topographies of the fjords enhance sediment redistribution. Episodic deposition of terrestrially derived sediment was responsible for roughly 50% of the Cs-137 and 45% of the Pb-210 inventories in shallower (less than 180 m) locations in Wilson and Bakewell arms of Smeaton Bay. Pb-210 sedimentation rates at shallower sites when corrected for episodic deposition were less than sedimentation rates obtained in deep basins of the fjords where sediment focusing and increased primary productivity in the overlaying water column occur. Higher fluxes of dissolved Mn from surficial sediments and subsequent reoxidation in the overlaying water may have enhanced scavenging of Pb-210 in basin locations resulting in higher inventories. Episodic events have occurred frequently in Smeaton Bay and Boca de Quadra suggesting that steady-state conditions with respect to sedimenting particles can be achieved only when averaged over long time periods approaching the time over which Cs-137 and Pb-210 are useful. (Author's abstract)
W91-06835

MARSH-WATER COLUMN INTERACTIONS IN TWO LOUISIANA ESTUARIES. I. SEDIMENT DYNAMICS.
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
D. L. Childers, and J. W. Day.
Estuaries ESTUDO, Vol. 13, No. 4, p 393-403, December, 1990. 6 fig, 1 tab, 42 ref.

Descriptors: *Estuaries, *Estuarine sediments, *Louisiana, *Salt marshes, *Sediment transport, *Sedimentation rates, *Wetlands, Barataria Basin, Flumes, Four League Bay, Water circulation, Water column, Water level fluctuations.

Throughflow marsh flumes were used to measure total sediment exchanges (TSS) between the marshes and water column of two Louisiana estuaries. One, the Barataria Basin estuary, is isolated from significant riverine sediment input. There were significant ($p < 0.05$) imports of 33.9 to 443 mg TSS/sq m/h at the Barataria Basin brackish marsh (BM) site. The Barataria Basin saltmarsh (SM) site exported TSS in two summer samplings, but significant uptake was measured in April (166 mg/sq m/h) and November (45 mg/sq m/h) during a winter frontal passage event. The other estuary, Fourleague Bay, receives large sediment inputs from the Atchafalaya River, the TSS imports of 22.5 to 118.5 mg/m2/h were measured at the BM site. Sediment accumulation from fluxes quantified in marsh flumes using site specific sedimentological data and flooding regimes were calculated for each site. Water level records from May 1987 to April 1989 showed an extended period of unusually low flooding frequencies. As a result, calculated accretion rates were low, with monthly rates of 0.02 to 0.11 mm and -0.06 to 0.06 mm at the Barataria BM and SM sites, respectively, and -0.18 to 0.08 mm at the Fourleague Bay marsh flume site. Actual net sediment deposition, determined by feldspar marker horizon analysis, was 0.7-1.6 mm/mo at the Barataria SM and 0.02-1.3 mm/mo at the Fourleague Bay BM. Even the highest calculated accretion rates, based on flume measurements, were half to one order of magnitude lower than actual measured sediment deposition. This discrepancy was probably because: (1) most sedimentation occurs during episodic events, such as Hurricane Gilbert in September 1988 which deposited 3.5-15.5 mm of sediment on Barataria Basin saltmarsh, or (2) most vertical accretion in Louisiana marshes occurs via deposition of in situ organic matter rather than by influx of allochthonous sediment. Results affirm the variability of short-term sediment transport and depositional processes, the close coupling of meteorologic forcing and flooding regime to sediment dynamics, and the importance of understanding these interrelated mechanisms in the context of longer term measurements. (See also W91-06837) (Author's abstract)
W91-06836

COMBINING A MODIFIED UNIVERSAL SOIL LOSS EQUATION WITH A DIGITAL TERRAIN MODEL FOR COMPUTING HIGH RESOLUTION MAPS OF SOIL LOSS RESULTING FROM RAIN WASH.
Gesellschaft fuer Systemforschung und Umweltplanung mbH, Ringstrasse 6, D-8041 Kranzberg, Germany.
W. Flacke, K. Auerswald, and L. Neufang.
Catena, Vol. 17, No. 4/5, p 383-397, August/October 1990. 4 fig, 22 ref.

Descriptors: *Mapping, *Model studies, *Rainfall impact, *Slope effects, *Slopes, *Soil erosion, *Terrain analysis, *Universal soil loss equation, Geographic information systems, Mathematical models, Rainfall, Runoff, Topography, Vegetation effects.

Soil loss must be predicted with high resolution for landscape planning in areas of complex topography. The length-slope factor LS is differentiated for an application on complex slope geometries, with specific consideration given to catchment

convergence and divergence. The result is a differentiated Universal Soil Loss Equation (dUSLE). A computational implementation on a surface model which has the structure of a triangulated irregular network contains the following information: polygons with information about precipitation, soil, and vegetation; small structures such as channels, roads, and hedgerows, which interrupt the erosive runoff; and the surface with its drainage network. Combination with the functions of a geographical information system leads to an application of the dUSLE which produces high resolution maps of soil loss by rainfall if the values of the R-, C-, K-, and P-factors are given. (Author's abstract)
W91-06907

EFFECT OF CRUDE OIL ON DENITRIFICATION AND SULFATE REDUCTION IN MARINE SEDIMENTS.
Centre d'Oceanologie de Marseille (France).
For primary bibliographic entry see Field 5C.
W91-06949

INTERANNUAL PATTERNS OF WATER TABLE HEIGHT AND GROUNDWATER DERIVED NITRATE IN NEARSHORE SEDIMENTS.
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 2F.
W91-06955

TOPOSEQUENCE OF FINE-TEXTURED SOILS IN THE HILLY AREA OF THE NORTHERNMOST PART OF HOKKAIDO: III. IMPORTANCE OF CHELATING LOW MOLECULAR ORGANIC ACIDS IN THE MIGRATION PROCESS OF ALUMINUM AND IRON.
Hokkaido Univ., Sapporo (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 2K.
W91-06972

MODEL OF RIVER BASIN EVOLUTION.
Newcastle Univ. (Australia). Dept. of Civil Engineering.
G. Willgoose, R. L. Bras, and I. Rodriguez-Iturbe.
EOS EOSTAJ, Vol. 71, No. 47, p 1806-1807, November 20, 1990. 1 fig, 23 ref. NSF Grant 8513556-ECE. Army Research Office DAAL03-89-K-0151, and National Weather Service Cooperative Research Agreement NA86AA-H-HY123.

Descriptors: *Geologic erosion, *Geologic history, *Geomorphology, *Model studies, *River basin development, *River basins, Catchment areas, Channel erosion, Computer models, Geohydrology, Mass transport, Mathematical equations, Mathematical models, Sediment transport.

A physically-based model of catchment evolution can advance a quantitative understanding of how channel networks and hillslopes evolve with time. Within the model discussed, neither the properties of the channel network nor the properties of the hillslopes can be viewed isolation; rather, they must be viewed as components of a complicated large-scale nonlinear system: the drainage basin. A computer model of river basin evolution is introduced and its performance illustrated. The new landscape evolution model has two main elements. First, the elevations within the catchment are simulated by a mass transport continuity equation applied over geologic time. The mass transport processes considered include both fluvail sediment transport and mass movement mechanisms such as creep, rainsplash, or landslide. The model explicitly differentiates between the processes that act on the hillslopes and in the channels. The model's second element is an equation that initiates the advance of the channel heads into the surrounding hillslopes. This advance occurs when a channelization initiation function, nonlinearly dependent on local discharge and slope, exceeds a threshold. Conceptually, the threshold can represent overland flow velocity or shear stress, subsurface flow criteria, or local landsliding criteria. A large number of catchment evolution simulations were performed with this model to test its behavior for a range of parameter sets, and these simulations were used to derive general laws of catchment form. (Hoskin-PTT)
W91-07026

BOUNDARY SHEAR STRESS AND ROUGHNESS OVER MOBILE ALLUVIAL BEDS.
EA Northwest Operations, Redmont, WA.
P. J. Whiting, and W. E. Dietrich.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1495-1511, December 1990. 6 fig, 1 tab, 47 ref. NSF Grants ENG78-16977 and CEE-8307142 and American Chemical Society Grant ACS-PRF-18427-AC2.

Descriptors: *Alluvial channels, *Boundary processes, *Hydraulic roughness, *Sediment transport, *Shear stress, *Turbulent flow, Algorithms, Bed load, Flow resistance, Mathematical equations, Model studies, Roughness coefficient, Streamflow.

The resistance to flow in the turbulent rough-flow range depends primarily upon the size, shape, and arrangement of the granular material making up the boundary. The hydraulic roughness of mobile alluvial surfaces was estimated by inverting sediment-transport formulas to solve for the local boundary shear stress required to predict the observed sediment flux and size. Inserting this shear stress value and a near-bed velocity measurement into the law of the wall yields the roughness scale, z0, defined as the height above the bed where velocity goes to zero. If the roughness is related to the coarse fraction of the bedload, such as D84, then z0 = 0.1D84. This roughness, obtained from mobile, naturally packed, and heterogeneous-in-size beds is three times greater than that predicted by the Nikuradse formula developed from nearly uniform and smoothly packed surfaces. No variation in roughness with transport stage was detected, implying that the large static and slowly moving grains determine flow resistance and that momentum extraction by saltating grain is minor. Application of this simple roughness algorithm allows convenient and accurate calculation of the local boundary shear stress. (Author's abstract)
W91-07031

AGGRADATION AND DEGRADATION OF ALLUVIAL SAND DEPOSITS, 1965 TO 1986, COLORADO RIVER, GRAND CANYON NATIONAL PARK, ARIZONA.
J. C. Schmidt, and J. B. Graf.
Available from Books and Open Files Reports Section, USGS Box 25425, Denver, CO 80225. USGS Professional Paper 1493, 1990. 74 p, 34 fig, 14 tab, 29 ref, append.

Descriptors: *Alluvial deposits, *Arizona, *Colorado River, *Grand Canyon National Park, *River sediments, Aggradation, Channel degradation, Channel morphology, Erosion, Flow profiles, River flow, River mechanics, Sand.

Alluvial sand deposits along the Colorado River in Grand Canyon National Park are used as campsites and are substrates for vegetation. The largest and most numerous of these deposits are formed in zones of recirculating current that are downstream from where the channel is constricted by debris fans at tributary mouths. Alluvial sand deposits are classified by location and form. Separation and reattachment deposits are downstream from constrictions within recirculation zones. Separation deposits are near the point of flow separation and typically mantle large debris fans. Reattachment deposits are near the point of flow reattachment and project upstream beneath much of the zone of recirculating current. Upper pool deposits are upstream from a constriction and are associated with backwaters. Channel margin deposits line the channel and have the form of terraces; some are created in small recirculating zones. Reattachment and channel margin deposits are largest and most numerous in wide reaches. During high flows, both separation and reattachment deposits are initially scoured but are subsequently redeposited during flow recession. Sand is also exchanged between the main channel and recirculation zones. The rate of recession of high flows can affect the elevation of alluvial deposits that are left exposed after a flood has passed. Comparison of areal photographs and reinterpretation of published data concerning changes of alluvial sand deposits following recession of high flows in 1983 and 1984, indicate that sand was eroded from recirculation zones in narrow reaches. In wide reaches, however, aggradation in recirculation zones may have occurred. In narrow reaches, the decrease of reattachment deposits was greater than that of separation deposits. In all reaches, the percentage of separation deposits that maintained a constant area was greater than for other deposits. Separation deposits, therefore, appear to be the most stable of the deposit types. (Lantz-PTT)
W91-07041

SEDIMENT TRANSPORT IN THE LOWER PUYALLUP, WHITE, AND CARBON RIVERS OF WESTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
W. G. Sikonia.
Available from Books and Open Files Reports Section, USGS Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 89-4112, 1990. 204p, 31 fig, 17 tab, 26 ref, 4 append.

Descriptors: *Carbon River, *Puyallup River, *Sediment transport, *Washington, *White River, River management, River sediments, Sediment control.

In 1983, the Pierce County Public Works Department began a study of flood protection for the lower Puyallup, White, and Carbon Rivers of western Washington. Information was obtained on sediment deposition, scour and movement in the river channels in response to potential alternatives for sediment control measures. This information was applied to investigate means of maintaining the flow carrying capacity of the river channels. Three alternative approaches for managing sediment deposition on the rivers were compared using a computer model of sediment transport. The three alternate courses of action were: (1) to continue gravel mining by the procedure of scalping gravel bars; (2) to install sediment traps; or (3) not to intervene at all with sediment control measures on the river system. Cross-section surveys and computer model results indicated that the rivers were degrading rather than aggrading throughout much of the study area. Accordingly, nonintervention would appear to be the most appropriate of the three alternatives for such reaches, because the other two courses of action mitigate aggradation, rather than degradation. Deposition of gravel and coarser material, as well as of sand and finer material, did occur in some reaches. Model results indicate that gravel was deposited at rates of 1 to 3 cu yd/ft of river distance, per year, in scattered localized reaches on the three rivers. To maintain bed elevations, the long-term average rate of gravel removal by scalping needs to equal the long-term average rate of deposition at the specific location. Sediment traps were shown by this model study to be an effective but inefficient course of action for removal of sand and finer material. Sediment traps modeled here reduced deposition of sand and finer material in the lower White and Puyallup Rivers by 78,000 cu yds/yr during the modeling period from August 16, 1984 to March 19, 1986. However this reduction would require maintenance removal of a combined total of 185,000 cu yds/yr of sand and finer material from model sediment traps on all three of the rivers. (Lantz-PTT)
W91-07045

SEDIMENT BUDGETS.
Proceedings of a Symposium held in Porto Alegre, Brazil, December 11-15, 1988. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. 591p. Edited by M. P. Bordas and D. E. Walling.

Descriptors: *Latin America, *Model studies, *Sediment budget, *Sediment erosion, *Sediment transport, *Sedimentation, *Symposium, Brazil, Catchment areas, Engineering, Land management, Sediment discharge, Sedimentary basins, Sediments.

The study of sediment budgets is in its infancy and more research is required to develop the necessary monitoring and modeling strategies and to improve understanding of the processes involved. There is an increasing awareness of the need to establish sediment budgets which attempt to quantify the relationships between the various components of the overall drainage basin erosion-transport-deposition system. The international Symposium on Sediment Budgets held in Brazil in 1988 considered a number of themes which are important in moving towards the goal of establishing meaningful sediment budgets, including physical processes, sediment monitoring, and sediment yields and sediment budgets. It is hoped that the proceedings of the symposium will provide a valuable resource for engineering and land management practices, particularly in Latin America. (See W91-07058 thru W91-07117) (Fish-PTT)
W91-07057

SEDIMENT LOSSES FROM CROPLAND FURROWS.
Agricultural Research Service, Fort Collins, CO. Hydro-Ecosystem Research Unit.
C. V. Alonso, L. D. Meyer, and W. C. Harmon.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 3-9, 2 tab, 5 ref.

Descriptors: *Cropland, *Furrow drainage, *Sediment erosion, *Sediment transport, *Sedimentation, *Soil erosion, Catchment areas, Drainage water, Rills, Sediment discharge, Sediments, Surface runoff.

Cropland fields with bedded rows are common for cotton in the humid South of the United States, and ridged rows are used for other crops and cropping conditions throughout the nation. For situations where these rows have a continuous gradient in one direction, they function as microwatersheds that drain the runoff and sediment between adjacent row ridges. Simulation experiments were performed using a physically-based mathematical model which treats the dynamic interrelations of runoff erosion, soil characteristics, and movement of eroded soil along bedded furrows. Data from a field study of bedded rows with furrow gradients ranging from 0.5 to 6.5% were simulated, and the role played by sediment and furrow parameters were examined. It was found that results from the simulations agreed well with the field measurements. It was determined that soil losses depend greatly on the furrow gradient. Much of the coarsest sediment may deposit at the flatter gradients but most will be carried at the intermediate gradients, and furrow rilling may occur at steep gradients. (See also W91-07057) (Author's abstract)
W91-07058

SEDIMENTATION OF FOUR REACHES OF THE MISSISSIPPI AND ILLINOIS RIVERS.
Illinois State Water Survey Div., Champaign.
N. G. Bhowmik, J. R. Adams, and M. Demissie.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 11-19, 5 fig, 4 tab, 5 ref. Illinois and Mississippi Rivers Project, Long-Term Ecological Program of the Division of Biotic Systems and Resources, National Science Foundation Grant BSR81-14563.

Descriptors: *Illinois River, *Mississippi River, *River basins, *River sediments, *Sediment erosion, *Sediment transport, *Sedimentation, Catchment areas, Deposition, Incised rivers, Mud flats, River mechanics, Sediment discharge, Sediment-carrying capacity, Sedimentary basins, Sediments.

The Illinois and Mississippi River basins are two of the largest river basins in the United States. Over the last 100 years or so, both of these rivers have been altered significantly by human activities. Extensive data on sediment input and deposition, including quality and characteristics of the sediment, were collected from a number of reaches of these rivers, analyzed, and evaluated. Pool 19 along the Mississippi River has lost about 58% of its capacity to sedimentation and may lose about 67% of its capacity by the year 2050, when it will attain a dynamic equilibrium. Pool 21 along the Mississippi River has also been an accumulator of sediment. Peoria Lake along the Illinois River has lost about 68% of its original capacity, and in another 15 to 20 years it may become reminiscent of an incised river with shallow mud flats on both sides. On the other hand, Pool 26 along the Mississippi River has been a net exporter of sediment. (See also W91-07057) (Author's abstract)
W91-07059

STREAM POWER AND SEDIMENT DEPOSITION IN FLOWING WATER (PUISSANCE HYDRAULIQUE ET DEPOT DE SEDIMENTS EN EAUX COURANTES).
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
M. P. Bordas, A. L. O. Borges, and P. Medeiros.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 21-33, 5 fig, 2 tab, 12 ref. English summary.

Descriptors: *Bed load, *Flow equations, *River sediments, *Sediment budget, *Sediment transport, *Sedimentation, *Streamflow, Brazil, Catchment areas, Hydraulic properties, Latin America, Sediment discharge, Sedimentary basins, Sediments, Stream discharge.

Knowledge of maximum solid load in a streamflow is essential for the calculation of sediment budgets, since it governs bed load routing on the stream bed. It is generally estimated using bed load formulae which are difficult to apply since their results may vary greatly. In an attempt to solve this problem, basic research was begun at IPH (Institut de Recherches Hydrauliques) in Brazil to define the hydraulic streamflow conditions which govern sediment deposition in flowing water. From these studies, relations were defined between maximum sediment load, stream power, grain size of sediments transported, and bed roughness with a higher precision than classical bed load formulae. (See also W91-07057) (Author's abstract)
W91-07060

GULLYING IN THE SOUTHEASTERN BRAZILIAN PLATEAU, BANANAL, SP.
Universidade Federal do Rio de Janeiro (Brazil). Dept. de Geografia.
A. L. C. Netto, N. F. Fernandes, and C. E. de Deus.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 35-42, 4 fig, 1 tab, 13 ref.

Descriptors: *Brazil, *Drainage patterns, *Gully erosion, *River basins, *Sediment erosion, *Sediment transport, *Soil erosion, Catchment areas, Latin America, Pipe flow, Sediment discharge, Sedimentary basins, Sediments, Seepage.

In the hilly lowlands of the southeastern Brazilian Plateau, the regional drainage network has been expanding into the tributary unchannelled basins ('rampa complexes') by gullying throughout the Holocene sediments. Gully development is dominated by seepage erosion, in a manner similar to the conceptual model of channel headward growth. The rate of removal of sediment stored in the gully floor by channelized runoff controls the rate of seepage erosion, and for the period November 1982 to January 1987 approximately 1076 cu m/year has been eroded at study site in a first order basin adjacent to a tributary of the River Bananal. The dominance of subsurface flow in the present rangeland environment may be due to the construction by 'Sauva' ants of tunnels in the soil through which overland flow enters the soil and generates pipe flow. (See also W91-07057) (Author's abstract)
W91-07061

MATHEMATICAL MODEL FOR RESERVOIR SILTING.
Sao Paulo Univ., Sao Carlos (Brazil). Escola de Engenharia.
P. R. J. Cogollo, and S. M. Villela.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 43-51, 5 fig, 1 tab, 5 ref.

Descriptors: *Dam effects, *Mathematical models, *Model studies, *Reservoir management, *Reservoir sediments, *Reservoir silting, *Sediment transport, *Sedimentation, Catchment areas, Colombia, Dams, Flow models, Latin America, Reservoir operation, River sediments, Sediment discharge, Sedimentary basins, Sediments.

The construction of a dam changes the natural equilibrium of a river: the flow velocity will be reduced and the sediment transported will be deposited in the reservoir. Estimation of the reservoir sedimentation rates and location of sediment is a complex task due to many interrelated factors, such as size and texture of the sediment particles, seasonal variations in river flow and sediment load, size and shape of the reservoir, and reservoir operation scheduling. A technique has been developed for estimating the sediment distribution in time and space into a lake. The river is modeled by a single channel assuming one-dimensional flow, and a set of multiple channels are used to simulate the river and flood plains in the reservoir. The physical boundaries for the model are: the flow and sediment rates at the upstream section of the river, and stages at a downstream section of the reservoir. The flow continuity and the flow momentum equation, and the sediment continuity equation are used to simulate gradually varied unsteady flow in natural alluvial channels. The model was applied to a reservoir in Colombia. The results were considered satisfactory at least from a qualitative point of view. A total calibration of the model could be made with bed elevations surveyed on at least two occasions. Almost all the sediment was deposited in the entrance of the reservoir. The jet theory assumes that the boundary of the jet spreads parabolically from the inlet section of the reservoir. For the case of a reservoir with multiple inlets, the interaction between jets must also be studied in the future. (See also W91-07057) (Fish-PTT)
W91-07062

MODEL EXPERIMENTS ON BED LOAD TRANSPORT IN THE VARIABLE BACKWATER ZONE OF A RESERVOIR.
Chengdu Univ. of Science and Technology (China). Dept. of Hydraulic Engineering.
D. Fang, Y. X. Chen, and J. Y. Chen.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 53-62, 5 fig, 4 tab, 6 ref.

Descriptors: *Backwater, *Bed load, *Model studies, *Reservoir sediments, *Sediment erosion, *Sediment transport, *Sedimentation, Catchment areas, China, Flood flow, Navigation channels, Reservoir operation, Reservoirs, Sediment discharge, Sedimentary basins, Sediments.

A lowhead reservoir situated on one of the tributaries of the Yangze River in China has a 58-year long-term hydrological series. Systematic model test observations were used to investigate the bed-load transport. During the study the annual bed load transport reached high, medium, and low flow quantities of 409,000, 280,000, and 96,000 tons, respectively. A discharge of 4,000 cu m/s was selected as a threshold for the project's operation. The regulation sluice can raise the upstream water level 10 m, and will be fully opened when the inflow is greater than the threshold discharge to remove the backwater effect from the whole reach. After 25 years of reservoir operation, the bed load will be reduced to 33.8% of that existing before construction. After 50 years, unidirectional deposition will cease, and the interchange between scour and deposition in any one year will approach a relative equilibrium. In the upper bend near the head of the backwater, the backwater effect is weak but the deposition is still appreciable. At full discharge, the scour activity is strong because of circulatory flow, and large amounts of the deposited sediment are pushed to the convex bank, in-

creasing the difference in elevation between the main channel and the flood plain. Although more sediment is deposited in the deep narrow reach during low flow periods, it will not obstruct navigation. The transition between two bends in the variable backwater zone is wide and shallow with a branch, and the main channel frequently shifts, causing navigational problems. Realignment of the transition was best accomplished by a series of longitudinal dikes, but still may not eliminate navigation interruption after a large flood peak. (See also W91-07057) (Fish-PTT)
W91-07063

GENERAL RELATION FOR THE LIMITING EQUILIBRIUM STATE FOR MOBILE NON-COHERENT BEDS (EXPRESSION GENERALE DU DEBUT D'EROSION D'UN FOND MOBILE NON-COHESIF).
Institut de Recherche et d'Etude d'Hydrotechnique et d'Amelioration, 136 Rue '9 Septembre,' 1618 Sofia, Bulgaria.
G. K. Gadjev.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 63-70, 2 fig, 3 tab, 12 ref. English summary.

Descriptors: *Model studies, *River beds, *Sediment erosion, *Sediment transport, *Sedimentation, *Turbulent flow, Catchment areas, Channel scour, Equilibrium, Flow equations, Flow velocity, Sediment discharge, Sedimentary basins, Sediments.

A dimensionless relationship for the limiting equilibrium state for mobile noncoherent beds is established on the basis of theoretical and experimental investigations. This relationship takes into account the turbulent intensity of the flow, and the probability of the limiting non-scouring pulsation velocity. The derived relationship is valid for the quadratic, the transient, and the laminar zones. As special cases for these zones, some formulae were proposed which give the critical bottom and mean velocities, given that the dimensional probability is defined with consideration of the importance and the category of the construction to be protected. The results obtained were confirmed by experiments. (See also W91-07057) (Author's abstract)
W91-07064

SILTING OF MOROCCAN DAMS.
Hydraulic Administration, Avenue Hassan Ben Chekroun, Casier Rabat Chellah, Morocco.
A. Lahlou.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 71-77, 2 fig, 3 tab, 1 ref.

Descriptors: *Dam effects, *Dams, *Morocco, *Reservoir silting, *Sediment transport, *Sedimentation, *Water resources development, Annual runoff, Catchment areas, Lithology, Prediction, Sediment discharge, Sediment yield, Sedimentary basins, Sedimentation rates, Sediments.

The increased development of water resources in Morocco increasingly demands a full knowledge and understanding of sediment generation and transport and of reservoir siltation. The various direct methods used for determination of the rates of silting of Moroccan reservoirs include: the bathymetric method, sediment monitoring, the stereophotogrammetric method, and the use of degradation prediction relationships for the upstream basins. Relationships between sediment yields from the watersheds and their surface area, their dominant lithology, and their annual runoff were used to establish a series of formulae for predicting the rate of siltation of dams constructed in any region of Morocco for various dominant lithologies. Sediment yield data were assembled from 15 river monitoring stations and from 23 dams where sedimentation rates had been calculated. This provided estimates of sediment yield or degradation for 38 drainage basins, representing a wide range of lithologies which made it possible to isolate the influence of basin lithology on sediment yield. The dam characteristics for which sedimentation rates were evaluated include the level of the thalweg, the initial capacity, the surface of the watershed, the annual silting and degradation based on an average density of 1.2 t/cu m for the material and an estimated trap efficiency, and the annual inflow. (See also W91-07057) (Fish-PTT)
W91-07065

EFFECTS OF SLOPE LENGTH, SLOPE GRADIENT, TILLAGE METHODS AND CROPPING SYSTEMS ON RUNOFF AND SOIL EROSION ON A TROPICAL ALFISOL: PRELIMINARY RESULTS.
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 4D.
W91-07066

HYDROLOGICAL CHARACTERISTICS AS A DETERMINANT OF SEDIMENT DELIVERY IN WATERSHEDS.
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
A. M. Matherine, and K. L. Prestegaard.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 89-96, 6 fig, 5 ref.

Descriptors: *Hydrologic cycle, *Hydrologic properties, *Rainfall-runoff relationships, *Sediment discharge, *Sediment erosion, *Sediment transport, *Soil erosion, *Watersheds, *Wisconsin, Catchment areas, Channel erosion, Groundwater, Runoff rates, Sedimentation, Sediments, Storm runoff.

Stream systems in southwestern Wisconsin, exhibit marked discontinuities in their channel networks and sediment budgets. The hydrological processes in these systems also demonstrate a variable response with scale. The large channels are surrounded by wide valleys with near-surface groundwater that can respond rapidly during summer storm events. Therefore the main channels will create major flows during the summer, carrying with them sediment stored on the river floor, provided shear stresses are sufficiently high. During the winter, groundwater levels in the tributary basins rise, enabling tributary channels to respond to snowmelt events. The tributaries do not respond to the low recurrence interval storm events. The infiltration capacity of the soil is too high and the groundwater table is too low. In Sand Creek, the stream system responded in an integrated manner only during a low magnitude (<1 year recurrence interval) storm that occurred during the end of the snowmelt period. A change in the hydrological behavior of the system occurs at the junction between the small tributaries with low groundwater tables and the larger channels with near-surface groundwater. Most gaging stations in Wisconsin and throughout much of the world are located on large perennial channels, and therefore are not capable of monitoring these changes in hydrological behavior that can have such a profound influence on erosion and deposition processes in the drainage basins. (See also W91-07057) (Fish-PTT)
W91-07067

TRANSPORT OF SUSPENDED SEDIMENT IN EPHEMERAL CHANNELS.
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Civil Engineering.
M. Nouh.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 97-106, 6 fig, 1 tab, 10 ref. King Abdulaziz City for Science and Technology, (Riyadh, Saudi Arabia) Saudi National Water Research Number AR-5-62.

Descriptors: *Ephemeral streams, *Model studies, *Saudi Arabia, *Sediment transport, *Sedimentation, *Suspended sediments, Catchment areas, Flash floods, Sediment discharge, Sediment erosion, Sedimentary basins, Shear stress, Storm runoff.

In Saudi Arabia, whose ephemeral channels (which carry water only during storms) are characterized by steep slopes, the amounts of transported sediment are large and cause serious deposition problems in surface reservoirs built primarily for water conservation. A program has been initiated to provide reliable information regarding the behavior of transported sediment in the ephemeral channels of Saudi Arabia. The results of this program, i.e., transport rates of suspended sediment in 37 straight ephemeral channels measured during a large number of flash flood events, were compared with the corresponding suspended sediment discharges computed with two different recently-developed approaches. The first approach calculates for a given discharge the suspended sediment transport rates of individual fractions, whereas the second approach calculates for the discharge the suspended transport rate for uniform sediment which is then converted to transport rates of non-uniform sediment using a multiplying corrective factor. These approaches were found to be unsatisfactory. A modification was developed for the second approach to improve its applicability in ephemeral channels. The modification considers the characteristics of flash flood hydrographs together with the characteristics of the channel and the sediments. The unique relation between the dimensionless shear stress and suspended load transport parameters for suspended load transport of uniform sediment can be used to predict the transport rate of individual fractions in a mixture during a flood flow by introducing a correction factor which is dependent on shear stress. The accuracy of the modified method in the ephemeral channels was found to be an improvement. (See also W91-07057) (Fish-PTT)
W91-07068

METHODS OF ESTIMATING BED LOAD TRANSPORT RATES APPLIED TO EPHEMERAL STREAMS.
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Civil Engineering.
M. Nouh.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 107-115, 5 fig, 14 ref.

Descriptors: *Bed load, *Ephemeral streams, *Model studies, *Saudi Arabia, *Sediment transport, *Sedimentation, *Unsteady flow, Catchment areas, Flash floods, Flow equations, Hydrographs, Sediment discharge, Sediment erosion, Shear stress, Storm runoff.

Ephemeral streams are generally characterized by steep slopes, high sediment transport rates, and unsteady and nonuniform flow rates. The sediment transported with the flow is nonuniform and covers a wide range of size and standard deviation. There is a lack of information concerning suitable methods for computing transport rates of nonuniform sediments under unsteady flow conditions. Bed load transport was measured in 37 straight ephemeral channels varying in width, slope, surface roughness, and flood flow characteristics, and transport rates were calculated with four different methods. The first method depends on the ratio of the mean grain size of the transported grain material to the subsurface geometric mean grain size; the second method uses a relationship between the dimensionless grain shear stress and bed load transport rate of nonuniform sediment by introducing a multiplying correction factor; the third method is the same as the second, but without the correction factor; and the fourth method uses the total shear stress on the bed instead of the shear stress due to grain resistance. Comparison of these methods of calculation with field measurements indicated that the first two methods gave the best results; the third and fourth methods gave poor results. Generally the accuracy of the methods decreased as the ratio of hydrograph depth variation with time to the inverse of the shear velocity increases, and the prediction during the descending period is more accurate than that during the rising period of hydrographs. To improve the applicability of the first methods in ephemeral channels, a modification which considers the effect of unsteady flow during flash floods produced satisfactory results in most of the investigated channels. (See also W91-07057) (Fish-PTT)

W91-07069

SUSPENDED SEDIMENT ROUTING ALONG A RESERVOIR.

Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ingenieria.
J. Gracia-Sanchez.

IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 117-124, 4 fig, 5 ref.

Descriptors: *Flumes, *Reservoir sediments, *Sediment discharge, *Sediment routing, *Sediment transport, *Sedimentation, *Suspended sediments, Density currents, Flow equations, Flow system, Flow velocity, Sediment erosion, Sedimentary basins, Slopes.

A revision of the most frequently used calculating procedures used to predict sediment location in a reservoir shows that they are of empirical character and that they do not always yield reliable results. Moreover, the analytic procedures are still in a developmental phase, especially those used to represent the behavior of fine sediments. Some experimental research was performed to examine the sediment movement along a reservoir, using a variable slope flume to simulate the reservoir. A total of 124 tests were performed, using different water discharges, slopes, sediment concentrations, temperature profiles, suspended sediment and lengthwise sections. The sediment movement was observed by means of measurements of the running length, depths, concentrations and temperatures. The general observed evolution of the transport phenomenon may be divided into three stages: (1) the water with sediment enters the reservoir quickly and then slows down until a density current appears; (2) the current moves at almost constant velocity while the discharge is constant; and (3) the inflow discharge stops and the current velocity diminishes gradually until it comes to a halt. A multifactorial analysis showed that the most important factors are slope, discharge, and their interaction; no important differences were observed regarding the use of the different types of sediment. The response surfaces gave an explanation of the evolution of the plunging zones, and a good representation of the sediment behavior for high slopes was obtained. A theoretical approach and computational procedure for predicting the phenomena is suggested. (See also W91-07057) (Fish-PTT)
W91-07070

SOME FACTORS AFFECTING EROSION OF BED CHANNELS PROTECTED WITH RIPRAP.

Sao Paulo Univ., Sao Carlos (Brazil). Dept. de Hidraulica e Saneamento.
E. C. Teixeira, and S. M. Villela.

IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 125-132, 6 fig, 1 tab, 6 ref.

Descriptors: *Channel erosion, *Erosion control, *Hydraulic design, *Riprap, *Sediment erosion, *Sediment transport, Bank erosion, Channel improvement, Channel stability, Erosion rates, Materials testing, Particle size, Slope protection, Unstable channels.

The design of stable channels for fine and noncohesive bed material commonly includes protection by an assemblage of discrete particles known as riprap. There are a limited number of studies about the erosive effect of flow on the base material with respect to its size distribution, the riprap layer thickness, and the riprap material size distribution. An experiment was performed to study some of the factors responsible for the erosion process acting on the base material of a stream bed protected by riprap. Using a uniform material for the riprap and two graded sands as base material, a series of experiments was designed and conducted in the laboratory to verify the effect of the protection thickness and of the base material size distribution on the base erosion process. It was found that the erosive effect of the flow at the base became more significant with increasing mean shear stress, and was strongly reduced as the riprap layer thickness increased. Differential erosion occurring at the base material was affected more significantly by riprap layer thickness than by base material size distribution. A dimensionless description of the observed data makes it possible to estimate either the protective layer thickness or the erosion rate of the base material. Based on the results of such experiments and a study of literature, conclusions may be drawn which permit the more confident design of riprap protection. (See also W91-07057) (Fish-PTT)
W91-07071

ANALYTICAL EVALUATION OF BED LOAD TRANSPORT IN A RIVER SUBJECT TO BACKWATER EFFECT: THE CASE OF THE RIVER TROMBETAS.

ENGE-RIO, Engenharia e Consultoria S/A, Departamento Engenharia Civil, Setor Comercial Norte, Quadra 6, Conj. A, Super Center Venancio 3000, Sala 601, B1.A, Brasilia/DF, CEP: 70710, Brazil.
L. C. Veiga Pires, L. O. Ribeiro, and A. R. S. R. Coimbra.

IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 133-138, 3 fig, 1 tab, 6 ref.

Descriptors: *Amazon, *Backwater effect, *Bed load, *Model studies, *River sediments, *Sediment discharge, *Sediment transport, Amazon River Basin, Brazil, Catchment areas, Critical velocity, Sediment erosion, Sedimentary basins, Sedimentation, Sediments, Tractive forces.

The calculation of bed load transport in a river is a problem that is difficult to solve. There are many formulae, based on tractive force, that estimate bed load discharge. These values are overestimated and generally inconsistent among themselves; in addition, this methodology does not take into account the velocities near the bottom. To overcome these problems, impact forces theory may be applied to calculation of bed load transport. The basic difference between these two methodologies is that, while in the first one the critical velocity is unique, the second one yields an interval throughout which velocity is critical and in which movement can occur according to a probability distribution. The utilization of these two methodologies allows the technician to have available an interval whose lower limit is the result obtained by the impact forces method, while the upper limit is given by the formulae based on tractive force. These two methodologies were used for the determination of bed load discharge in River Trombetas, a tributary of the River Amazon in Brazil. The results show that the bed load discharges obtained through the impact forces method are plausible. The suspended load, found to be near 1,300,000 t/year, leads to the conclusion that the tractive forces theory overestimated bed load transport. But, through the impact forces method, the bed load found was very coherent; the proportion of bed load to suspended load usually found was maintained at 10 to 30%. (See also W91-07057) (Fish-PTT)
W91-07072

CROPPING PATTERN AND ITS ROLE IN DETERMINING EROSION RISK: EXPERIMENTAL PLOT RESULTS FROM THE MUGELLO VALLEY (CENTRAL ITALY).

Florence Univ. (Italy). Dipt. di Scienze della Terra.
C. Zanchi.

IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 139-145, 1 fig, 4 tab, 3 ref. CNR, Italy, Special Grant IPRA, Subproject 2, Paper no. 1817.

Descriptors: *Agricultural practices, *Italy, *Land management, *Risk assessment, *Sediment erosion, *Sediment transport, *Soil conservation, *Soil erosion, Agricultural runoff, Corn, Cropland, Erosion control, Erosion rates, Pastures, Runoff coefficient, Runoff rates, Sediments, Surface runoff, Wheat.

The evaluation of soil loss related to different crops is of primary importance, since biological measures are often the only applicable conservation practices on hilly lands. Runoff and soil loss data (runoff and runoff coefficients) collected from 1979 to 1987 were examined for nine experimental plots (20 m long, 5 m wide, 14% slope) in the Mugello Valley in central Italy, planted with three different crops (wheat, corn, pasture). It was determined that there is evidence of the efficacy of pasture in reducing runoff and soil loss in comparison with that recorded from corn and wheat plots. Pasture cover limited soil losses to below the maximum level of soil erosion tolerance, which for this soil is about 7 t/ha/year. This soil loss tolerance level was greatly exceeded by the corn and to a lesser extent by the wheat plots. The winter months evidence the highest erosion risk for all crops, but corn experienced another dangerous period in May-June, related to the stage which immediately follows sowing. The experimental values of the cover and management factor are in accordance with those derived from the Universal Soil Loss tables of 1978. Mean annual values of the cover and management factor were estimated at 0.13, 0.37, and 0.03, respectively, for wheat, corn, and pasture. On the basis of experimental results, it is important to note that, in order to maintain the erosion within the admissible soil loss tolerance, corn would need to follow five years of pasture. The results also indicate that, in some Italian environments, it may be possible to utilize the Universal Soil Loss Equation which provides a useful tool for planning agricultural systems to conserve the soil fertility. (See also W91-07057) (Fish-PTT)
W91-07073

MONITORING PROGRAMME OF SEDIMENT TRANSPORT IN NORWEGIAN RIVERS.

Norges Vassdrags- og Elektrisitetsvesen, Oslo.
J. Bogen.

IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 149-159, 7 fig, 7 ref.

Descriptors: *Erosion, *Monitoring, *Norway, *Rivers, *Sediment erosion, *Sediment transport, *Sedimentation, Bed load, Catchment areas, Glacial streams, Land management, Mountain streams, Particle size, River basins, River sediments, Sediment discharge, Sediment yield, Sedimentary basins, Suspended sediments.

A national sediment monitoring program has been set up by the Norwegian Water Resources and Energy Administration to study erosion processes and sediment production in catchment areas. Analyses of concentrations of suspended organic and inorganic particulate matter, and their size distributions and mineralogy are carried out in the program. Bed load is estimated from measurements of deltaic growth in lakes. There are four main types of rivers in Norway: lowland rivers draining forested till areas, rivers draining clay areas below the postglacial marine limit, glacial rivers, and rivers in arctic and high mountain areas without glaciers. Present knowledge of sediment yield and sediment related environmental problems due to the various activities within the drainage basins show that the largest suspended sediment yields are derived from subglacial erosion. In the lowland river basins characterized by coniferous forest and no glaciers, sediment yields are to a large extent controlled by the availability of loose material and the protective effect of the vegetation. There is considerable variability in the particle size characteristics of suspended sediment in the various types of rivers. The most fine-grained suspended sediment occurs in the marine clay areas. Glacial erosion of the igneous and metamorphic rocks in southern Norway produces relatively coarse particles. Grain size is poorly correlated with discharge, and more dependent on the type of sources and the development of the drainage system through the runoff season. (See also W91-07057) (Fish-PTT)
W91-07074

SELECTION OF REPRESENTATIVE AND EXPERIMENTAL BASINS FOR THE STUDY OF EROSION ON THE SOUTH AMERICAN PLATEAU (CHOIX DE BASSINS REPRESENTA-

TIFS ET EXPERIMENTAUX POUR L'ETUDE DE L'EROSION SUR LE PLATEAU BASALTIQUE SUDAMERICAIN).
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
A. L. de O. Borges, and M. P. Bordas.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 161-169, 2 fig, 3 tab, 7 ref. English summary.

Descriptors: *Computer models, *Experimental basins, *Sediment erosion, *Sedimentary basins, *South America, Brazil, Catchment areas, Climatic zones, Computerized maps, Land management, Sediment discharge, Sediment yield, Sedimentation, Sediments, Suspended sediments.

Land management efforts on the South American basaltic plateau region has necessitated determination of physico-climatic zones and representative basin types within each of these zones. A computer modeling strategy has been developed for selecting basins for use in defining sediment production functions in basins of less than 1000 sq km. Existing methods were adapted to local circumstances, particularly the specific height difference concept to express the influences of topography. Thirteen physico-climatic zones were defined, five of which occupy 77% of the study region. These zones coincide with the map of specific suspended sediment production utilized in the regionalization of erosion and sedimentation risks in Brazil made in 1988. It is not necessary to install a representative basin for each of the similar zones: analyzing the spatially discriminating models to judicially choose a representative basin, it is possible to reproduce the basin characteristics such that the elementary production functions are entered into the program. The strategy for producing the appropriate scenario involves choice of a strategically representative basin, and identification of experimental basins on which definition is needed of the elementary production functions. (See also W91-07057) (Fish-PTT)
W91-07075

METHOD FOR DETERMINING SEDIMENT BUDGETS USING CAESIUM-137.
Australian Nuclear Science and Technology Organisation, Sutherland.
B. L. Campbell, R. J. Loughran, and G. L. Elliott.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 171-179, 2 fig, 24 ref.

Descriptors: *Analytical methods, *Cesium radioisotopes, *Isotopic tracers, *Land management, *Sediment budget, *Sediment erosion, *Sediment transport, *Tracers, Catchment areas, Isotope studies, Sediment sampler, Sedimentary basins, Sedimentation, Sediments, Soil erosion.

Cesium-137 is a globally distributed product of nuclear weapons tests which has widespread but under-utilized applications as a tracer of soil and sediment movements. Contrary to such equations as the Universal Soil Loss Equation, which are calibrated under limited conditions, the 137-Cs method provides real data which are specific to the site. It may be used to identify sediment sources and storages which are the most difficult components to quantify in a sediment budget. The simple technique uses technical aspects often neglected in scientific papers. Soil samples are scraped at depth increments using a beveled aluminum blade with depth guide. The sampling area is defined within a 200 x 500 mm steel frame made from a 30-45 mm wide angle iron frame hammered into the soil surface to a depth intersecting the entire 137-Cs distribution. In the laboratory, simple treatment of the samples, followed by gamma-ray spectrometry enables calculation of 137-Cs concentration in various units (1/g, 1/sq cm). Comparison of 137-Cs values from the sampling site relative to a reference site shows the gain or loss of 137-Cs time-averaged for the period 1954-1988. Construction of iso-cesium lines may reveal patterns of soil loss but nevertheless soils can be ranked for apparent soil degradation. The measured 137-Cs loss versus measured net soil loss (kg/ha/year) can be calibrated within confidence limits, and these variables correlated with productivity yields. This allows production of maps of estimated net soil loss in the basin. Sediment collected by water sampling at basin outlets can also be retrieved for 137-Cs 'fingerprinting.' (See also W91-07057) (Author's abstract)
W91-07076

STRATEGY FOR ORGANIZING A SEDIMENT DATA COLLECTION NETWORK BASED ON THE AVAILABLE HYDROLOGICAL RECORDS FOR A CATCHMENT IN KENYA.
Ministry of Water Development, Mombasa (Kenya).
S. H. Charania.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 181-188, 5 fig, 4 tab, 1 ref.

Descriptors: *Hydrologic data collections, *Kenya, *Land management, *Network design, *Sediment erosion, *Sediment transport, *Sediment yield, Africa, Catchment areas, Costs, Data requirements, Flow duration, Sediment discharge, Sedimentary basins, Sediments, Streamflow data.

The sediment loads of rivers can give rise to many problems in terms of water resource development and there is an important need for sediment data in many areas. A network of stations must be established for regular data collection and a strategy must be developed to ensure adequate data collection for the purpose. The Tana catchment in Kenya was employed to demonstrate how such a strategy could be developed. Flow duration analysis was carried out for each station using the daily flows and the total year method of analysis. The flows were sorted into classes and the relative frequencies and probabilities of flow were obtained. The flow duration curves were plotted on normal arithmetic paper. Sediment yields were calculated and the equation of the sediment rating curve for each station was obtained by plotting the sediment yields against the corresponding water flows on log-log paper. These curves were used to convert the daily discharges into daily sediment yields. The annual sediment yields at each station were determined by two methods: using the flow duration curve and the sediment rating curve for each station; and using the sediment rating curve and the daily discharge series for the station. The ratio of the two sediment yield values was used as a correction factor for the daily sediment yield values in the final analysis. Further analysis to determine the relationship between flow magnitude and the corresponding proportion of the total sediment yield was done to confirm that sufficient information will be obtained through limited data collection. It was concluded that there is no need to undertake sediment sampling all times during the year. If a reasonable error of, for instance, 5% was permitted, sampling at the stations in the Upper Tana could be reduced by at least 40%, leading to significant reductions in costs of sampling and more effective use of the few instruments available for the purpose, without any significant reduction in the accuracy of the results. (See also W91-07057) (Fish-PTT)
W91-07077

EVALUATION OF LONG TERM SUSPENDED SEDIMENT RECORDS FOR SELECTED CANADIAN RIVERS.
Environment Canada, Ottawa (Ontario). Water Resources Branch.
T. J. Day.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 189-195, 3 fig, 1 tab, 7 ref.

Descriptors: *Canada, *Data collections, *Rivers, *Sediment erosion, *Sediment transport, *Suspended sediments, Catchment areas, Data requirements, Reservoir sediments, Sediment discharge, Sedimentary basins, Sedimentation, Streamflow data.

Long term suspended sediment monitoring in Canadian rivers began in the 1950s for purposes which included documentation of geophysical processes and reservoir sedimentation. Many detailed (50-200 samples/year) data records with lengths of 10-30 years now exist. Presently both economic concerns and an awareness of different environmental applications have prompted a review of these records. Results indicate, for example, that mean characteristics are stable after about 10 years, and that a good range of conditions has been sampled. Long term records of suspended sediment transport are of limited use in documenting geophysical processes due to the limited sensitivity of basin response and to the complication of natural and man-induced changes. As a consequence of these reviews, the emphasis of Canadian sediment monitoring activities is shifting towards shorter term programs with a reduced number of samples. (See also W91-07057) (Author's abstract)
W91-07078

ASSESSING SEDIMENT SOURCES IN A SMALL DRAINAGE BASIN ABOVE THE TIMBERLINE IN THE PYRENEES.
Instituto Pirenaico de Ecologia, Jaca (Spain).
J.-C. Diez, B. Alvera, J. Puigdefabregas, and F. Gallart.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 197-205, 3 fig, 10 ref.

Descriptors: *Erosion, *Mountain watersheds, *Pyrenees Mountains, *Sediment sources, *Sediment transport, *Sedimentary basins, *Sedimentation, *Sediments, *Small watersheds, *Spain, Alpine regions, Catchment areas, Drainage patterns, Geomorphology, Sediment discharge, Storm runoff, Surface runoff.

Sediment transfer pathways between hillslopes and channels in alpine grasslands are poorly understood. The geomorphic work processes were observed in a small alpine drainage basin in Spain to estimate their relative contribution to the sediment budget. It was seen that most of the geomorphic work performed in the Izas basin is used to change its shape, and only a small part of the material moved is exported from it. Mass wasting is very active on the hillslopes, but is disconnected from the drainage network and its work cannot be expressed in terms of sediment yield. The drainage system itself, including the pipe network, is usually the main source of the sediment it transports, but this is primarily coarse material produced by cutting gorges and which is partially accumulated in depressions. Intense summer rainstorms are able to partially integrate the efficient sediment yielding hillslope and the fluvial processes, but their role is uncertain, because the recurrence interval of such storms is not known. Under these conditions, chemical weathering and dissolved transport seem to be the most effective mechanism for export of material from the basin. (See also W91-07057) (Author's abstract)
W91-07079

NATURE OF COARSE MATERIAL BED LOAD TRANSPORT.
Freie Univ. Berlin (Germany, F.R.). Inst. fuer Physische Geographie.
P. Ergenzinger.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 207-216, 4 fig, 23 ref.

Descriptors: *Bed load, *Erosion, *Particle size, *River sediments, *Sediment transport, *Suspended sediments, Catchment areas, Channel flow, Channel morphology, Flood waves, Italy, Montana, Sediment discharge, Sedimentary basins.

The principles governing the conditions for coarse bed load movement have often been questioned. Existing bed load formulae concentrate on the hydraulic conditions necessary to initiate pebble motion, but research carried out in the Buonamico basin in southern Italy and in Squaw Creek, Montana, U.S., indicates that bed load transport is more complicated. The hydraulic conditions are of para-

mount importance, but other factors such as sediment supply and channel form changes have to be examined to comprehend the specific wave-like movement of bed load during a flood wave. These aspects are further complicated by apparent changes in the types of waves of bed load transport. Channel geometry has been studied in order to ascertain whether or not the passage of waves of bed load material can be directly measured. Changes in the channel form can be attributed to the passage of such waves through the channel systems and they also correspond well to the varying hydraulic conditions that influence the removal of storage of material within the reach. It is therefore important that bed load transport equations should be questioned by devising a continuous recording technique for bed load transport with simultaneous investigations of changes of channel geometry, sediment supply, and types of bed load movement. (See also W91-07057) (Author's abstract)
W91-07080

DEVELOPMENT AND FLUME CALIBRATION OF A NEW TYPE OF NEAR-STREAMBED SUSPENDED LOAD SAMPLER.
Chengdu Univ. of Science and Technology (China). Dept. of Hydraulic Engineering.
D. Fang, and G. D. Wang.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 217-224, 4 fig, 2 tab, 4 ref.

Descriptors: *Bed load, *Samplers, *Sediment sampler, *Sediment transport, *Suspended load, *Suspended sediments, Calibrations, Flumes, River sediments, Rivers, Sediment contamination, Sediments, Streambeds.

To calculate the absolute sediment concentration at a certain point in the vertical profile of river flow, the sediment concentration near the streambed must be known. Using a conventional suspended load sampler, it is generally impossible to measure the layer of high sediment concentration near the streambed. As a result, the accuracy and value of the collected data are greatly reduced. A new type of near-streambed instantaneous suspended load sampler has been developed. A stay line is used to increase the stability and to help to increase the effectiveness of the sampler. When the sampler has been moved to the predetermined sampling point along its electric cableway, the electromagnetic switch installed on the river bank is used to close the lids on the two ends of the sampling container and collect the sample. The instrument's reliability and value have been verified by flume calibration. A feasible means of solving the problem of total load measurement in large rivers is therefore provided. (See also W91-07057) (Author's abstract)
W91-07081

ESTIMATING EROSION USING CAESIUM-137: I. MEASURING CAESIUM-137 ACTIVITY IN A SOIL.
University of New England, Armidale (Australia). Dept. of Resource Engineering.
D. J. Fredericks, V. Norris, and S. J. Perrens.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 225-2 tab, 12 ref.

Descriptors: *Australia, *Cesium radioisotopes, *Isotopic tracers, *Sediment erosion, *Sediment transport, *Soil erosion, Analytical methods, Estimating, Isotope studies, Land use, Sediments, Universal soil loss equation.

Most estimates of topsoil erosion in sediment budgets rely on the use of the Universal Soil Loss Equation. The applicability of this empirically derived equation beyond the data base from which it was derived will always be open to question. The measurement of the retention of the fallout isotope 137-Cs has the potential to provide a universal physically based method of estimating soil loss. Mean areal activities of 137-Cs under forest, grazing, and cultivated land use in northern New South Wales, Australia, were estimated. Activities under each land use were significantly different; the forest site had the greatest 137-Cs activity and the cultivated sites had the least. Variability in 137-Cs activity at each site was high and was primarily dependent on land use. The coefficient of variation ranged from 21% for a 0.4 ha cultivated site to 45% for the 0.02 ha grazing site. Variability was attributed to (a) an initially nonuniform distribution of 137-Cs within the soil, (b) small scale redistribution of topsoil controlled by microtopography and not resulting in a net export of soil, and (c) erosion. Estimates of the number of samples required to estimate a mean activity with a standard error of less than 5% ranged from 19 for the cultivated sites to over 80 for the grazing site. The large number of samples required to accurately estimate a mean activity makes the routine application of this technique impracticable. A method for estimating activity by bulk sampling is suggested for these applications. (See also W91-07057) (Author's abstract)
W91-07082

ESTIMATING EROSION USING CAESIUM-137: II. ESTIMATING RATES OF SOIL LOSS.
University of New England, Armidale (Australia). Dept. of Resource Engineering.
D. J. Fredericks, and S. J. Perrens.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 233-240, 2 fig, 8 ref.

Descriptors: *Australia, *Cesium radioisotopes, *Erosion rates, *Isotopic tracers, *Sediment erosion, *Soil erosion, Estimating equations, Isotope studies, Land use, Mass transfer, Model studies, Sediment transport, Sediments.

Most estimates of topsoil erosion in sediment budgets rely on the use of the Universal Soil Loss Equation. The applicability of this empirically derived equation beyond the data base from which it was derived will always be open to question. The measurement of the retention of the fallout isotope 137-Cs has the potential to provide a universal physically based method of estimating soil loss. Three methods are available for converting a measurement of 137-Cs depletion in a soil to an estimate of soil loss: (1) a simple linear relationship between the two variables; (2) empirically-derived relationships between the reduction in 137-Cs activity and soil loss; and (3) mass balance models. Each of these techniques was used to estimate rates of soil loss from a site at Inverell, Australia. using a linear relationship soil loss was calculated to be 106 t/ha/year. Estimates of soil loss using a mass balance model were found to be greatly affected by the assumptions used in the model and the temporal distribution of soil loss events used in the model (25-80 t/ha/year). The empirically-derived relationship was found to yield estimates an order of magnitude lower (1.5 t/ha/year). Each method needs to be calibrated using erosion plot data for a wide variety of soils and land uses before any confidence can be placed in estimates of soil loss. (See also W91-07057) (Author's abstract)
W91-07083

IDENTIFICATION OF SOURCES OF SEDIMENT TRANSPORT IN SMALL BASINS WITH SPECIAL REFERENCE TO PARTICULATE PHOSPHORUS.
Copenhagen Univ. (Denmark). Inst. of Geography.
B. Hasholt.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 241-250, 2 fig, 4 tab, 17 ref.

Descriptors: *Denmark, *Nutrient transport, *Path of pollutants, *Phosphorus, *Sediment erosion, *Sediment sources, *Sediment transport, *Sediments, *Small watersheds, Catchment areas, Erosion rates, River basins, Runoff, Sediment discharge.

An increasing oxygen deficiency in Danish lakes and coastal waters has caused great concern about the transport of nutrients to water courses. The Danish Ministry of the Environment has sponsored a project that deals with the various aspects of the transport of nutrients to the aquatic environment. One part of the study quantifies the contribution of different erosion sources to the total transport of phosphorus. Two basins were selected (approximately 10 sq km), where climatic parameters, discharge, and sediment transport are recorded continuously at the outlets. The basins are monitored once a week for occurrences of erosion which, if observed, are quantified. Preliminary results from investigation performed during the winter of 1987/88 show that, when the different types of erosion found during the weekly field trips were distributed over time using continuous records of transport and the sum for the period computed, sediment transport from sources other than the stream bed and banks and wetlands in the river valley are insignificant for the Rabis Baek basin. Very little rill erosion occurred during this year and this was not at locations where it could influence transport at the monitoring stations. This is due to the extremely mild and rainy winter during which a large amount of water has been able to infiltrate instead of flowing across the frozen surface. It is proposed to continue the field investigations for a further year in order to obtain more data to improve the statistical computations and extrapolation of the findings to other areas. (See also W91-07057) (Author's abstract)
W91-07084

MANAGEMENT OF SEDIMENT MONITORING AT THE DRAIX EXPERIMENTAL BASINS (LA GESTATION DU BASSIN VERSANT EXPERIMENTAL DE DRAIX POUR LA MESURE DE L'EROSION).
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Saint-Martin d'Heres (France). Grenoble Group.
R. Mura, J. P. Cambon, F. Combes, M. Meunier, and J. Oliver.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 251-258, 5 fig, 1 tab. English summary.

Descriptors: *Erosion, *Erosion rates, *Experimental basins, *Experimental design, *France, *Monitoring, *Sediment transport, Forest watersheds, Sediment discharge, Sedimentary basins, Soil erosion, Soil types, Vegetation effects.

The five experimental basins of Draix are located in the southern, Mediterranean part of France; their geology consists of marls with badland facies. A set of three basins with surface areas of 78 to 108 ha, and which are distinguished by the amount of vegetative cover, was selected for the study of erosion as a function of vegetation. The investigation began in 1984, but useful and continuous results have only existed since 1985 for the Roubine and Laval Basins and since 1987 for the Brusquet Basin. For non-vegetated soil the loss of earth seems to be independent of the soil surface over a long period (a year or more). The analysis of the individual parameters of throughflow show an extreme difference in behavior between the forested basin and the two others, which seems capable of explanation only through the effect of the forest. There were some problems in obtaining measurements of sediment discharge and in the interpretation of these measurements. Therefore, these results and interpretations should be confirmed by the continued collection of data over a much longer period. (See also W91-07057) (Fish-PTT)
W91-07085

EXAMINATION OF THE ROLE OF SAMPLING STRATEGIES IN THE STUDY OF SUSPENDED SEDIMENT TRANSPORT.
University Coll., Campbell (Australia). Dept. of Geography and Oceanography.
L. J. Olive, and W. A. Rieger.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 259-267, 6 fig, 18 ref.

Descriptors: *Experimental design, *Sediment erosion, *Sediment sampling, *Sediment transport, *Suspended sediments, Artificial storms, Erosion

rates, Monitoring, Sediment discharge, Stream discharge, Turbidity.

Studies of contemporary stream sediment transport have been used to determine erosion and denudation rates. Little attention has been given to the very important temporal relationships which exist between suspended sediment and stream discharge and the errors introduced by deficiencies in the temporal bases of sampling programs which do not adequately sample variability through time. To obtain an idea of the possible errors involved, synthetic storm event series were generated at one minute intervals over a ten-hour period. The three types of storm event series represent common suspended sediment responses: (1) single rise hydrograph with sediment concentration lead; (2) double rise hydrograph with sediment concentration lead and sediment depletion; and (3) multiple rise hydrograph with no identifiable pattern to suspended sediment concentration. A simulation of different sampling time intervals for the calculation of loads clearly demonstrated the loss of information and changes in the nature of the series which result from using a less frequent sampling interval; where the temporal sampling strategy is inadequate, errors in load calculation can result. There are relatively small errors in load estimation for sampling time intervals less than 30 min; the starting point for the estimation of load for a given sampling time interval is critical as seen in the range of values for the different starting points. It was concluded that continuous monitoring using an indirect technique such as turbidity may result in a more accurate data set despite the inherent problems involved in such techniques. (See also W91-07057) (Author's abstract)
W91-07086

TECHNIQUES FOR ESTABLISHING SUSPENDED SEDIMENT SOURCES IN TWO DRAINAGE BASINS IN DEVON, UK: A COMPARATIVE ASSESSMENT.
Hong Kong Univ. Dept. of Geography and Geology.
M. R. Peart, and D. E. Walling.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 269-279, 2 fig, 4 tab, 15 ref.

Descriptors: *England, *Sampling, *Sediment load, *Sediment sources, *Sediment transport, *Suspended sediments, Bank erosion, Catchment areas, Cesium radioisotopes, Channel erosion, Geologic control, Isotopic tracers, River basins, Sediment discharge, Sediment erosion, Sedimentary basins.

There is an increasing need for information concerning the source of the sediment load leaving a drainage basin. However, such information is difficult to obtain. Traditional methods include both direct and indirect approaches. The 'fingerprinting' technique, based on measurements of sediment and source material properties, has been developed more recently. Several of these methods of sediment source determination have been applied in two drainage basins in Devon, England. It was found that the construction of suspended sediment concentration/discharge hysteresis rating relationships do not, without additional information, permit the evaluation of sediment source in terms of a within-channel, surface soil division. The channel bank erosion study indicates that this source provides sediment to the channel system. However, because of problems associated with sediment storage and evaluating erosion it is difficult to quantify the contribution made by bank erosion. Nevertheless, it is believed that process studies afford the best method of evaluating new techniques of sediment source evaluation, such as 'fingerprinting.' In the study basins the 'fingerprinting' methodology proved most capable of determining sediment source. However, in the case of the Jackmoor Brook and the river Dart the relatively homogeneous geology underlying the basins may have simplified the problem of finding properties capable of distinguishing topsoil from substrate material. In drainage basins with nonheterogeneous geology this will be more difficult. In such situations 137-Cs may be the better tracer since its behavior is largely independent of rock character. (See also W91-07057) (Fish-PTT)
W91-07087

SEDIMENT PRODUCTION AND TRANSPORT ON THE SQUARE KILOMETRE SCALE IN HUMID SAVANNAH, IVORY COAST (LA PRODUCTION DE SEDIMENTS SUR LES VERSANTS ET LEUR TRANSPORT A L'ECHELLE DU KM-SQ EN SAVANE HUMIDE, COTE D'IVOIRE).
Office de la Recherche Scientifique et Technique Outre-Mer, Montpellier (France).
O. Planchon.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 281-291, 4 fig, 2 tab, 6 ref. English summary.

Descriptors: *Erosion, *Ivory Coast, *Savannas, *Sediment transport, *Sediment yield, *Slope effects, Catchment areas, Cover crops, Erosion rates, Flood flow, Sediment discharge, Sediments, Soil erosion.

The sediment production on the slopes of a 1.39 sq-km basin in the Ivory Coast was studied by means of small pits and sediment transport downslope (by examining flood propagation down the erosion ravines). The study showed that, at the level of the slopes, the erosion is more important at the beginning of the rainy season when the landscape is still bare after brush fires. However, the floods in the erosion ravines reach the backwater only at the end of the season when the water table is at its highest. Thereby, the erosion on the slope scale and the erosion on the basin scale are controlled by a number of contradictory phenomena. It was also seen that cropping can modify this equilibrium. (See also W91-07057) (Author's abstract)
W91-07088

PRELIMINARY ESTIMATE OF BED LOAD USING MEAN GRAIN SIZE DISTRIBUTION DATA.
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
F. R. Semmelmann, M. P. Bordas, and A. E. Lanna.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 293-299, 3 fig, 1 tab, 9 ref.

Descriptors: *Bed load, *Brazil, *Particle size, *Sampling, *Sediment transport, *Sediment yield, *Suspended sediments, Bed-load discharge, Catchment areas, Distribution patterns, Gaging stations, Latin America, Sediment discharge, Sedimentary basins.

When sediment yield data, generally derived from suspended discharge measurements, are used for specific projects, the determination of total load may become necessary. Relationships between parameters of grain size distributions of river bed material and suspended sediments may be used to obtain estimates of the importance of bed load, expressed as a percentage of suspended load. These relationships were examined using 59 Brazilian sediment gaging stations. A considerable degree of relative bed load importance was associated with the following conditions: (1) bed material which contributes to suspended load is predominant; (2) bed sediment is predominant in suspended load size distributions; (3) the relative importance of size fractions which are contained in bed material and in suspended load is similar, provided that grain sizes occurring in both size distributions are predominant; and (4) the degree of uniformity of the size distributions of bed material and suspended sediment load is coincident in both distributions. Moderate relative importance of bed load was found to be associated with the first two conditions. Low relative importance of bed load was found to be associated with predominance of wash load or reduced importance of those grain size fractions of bed material contributing to suspended load, together with different degrees of uniformity of sediments and bed material. The gaging stations were classified by wash load/suspended bed sediment predominance and probable relative importance of bed load. The relative frequency (52%) of stations with predominant wash loads in suspended load size distributions was significant. All cases of wash load predominance coincided with low relative bed load importance at the mean suspended load concentration levels observed (<1200 ppm). A comprehensive interpretation of the distributions requires consideration of many parameters such as land use patterns, soil and climatic conditions, reservoir effects, grade variations, and other parameters. (See also W91-07057) (Fish-PTT)
W91-07089

ANALYSIS OF THE QUALITY OF SUSPENDED SEDIMENT DATA.
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
F. R. Semmelmann, and A. E. Lanna.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 301-305, 2 fig, 1 tab, 8 ref.

Descriptors: *Brazil, *Data quality, *Data quality control, *River sediments, *Sampling, *Sediment load, *Statistical methods, *Suspended sediments, Error analysis, Gaging stations, Sediment concentration, Sediment transport, South America.

For inhomogeneous river conditions, the practice of excluding statistical outliers from the calculation of cross-sectional mean suspended load concentrations may introduce significant error (due to elimination of components of the group mean), instead of the intended improvement in data quality. It is proposed to examine outliers (samples) of inhomogeneous river reaches or cross sections with regard to compatibility of operational procedure and flow conditions, before deciding on the elimination of such samples; following this procedure the representative character of mean concentration values would be maintained and quality could be improved. In the example studied (30 suspended load measurements at the Indaial sediment gaging station on the River Itajai-Acu in southern Brazil) an improvement in the quality of mean concentration values was observed, after elimination of defective samples. (See also W91-07057) (Author's abstract)
W91-07090

EROSION STUDIES IN SUME, A SEMIARID REGION IN THE NORTHEAST OF BRAZIL.
Universidade Federal da Paraiba, Campina Grande (Brazil). Dept. of Civil Engineering.
V. S. Srinivasan, H. P. Gomes, J. C. Leprun, and I. G. Silva.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 307-314, 4 fig, 2 tab, 5 ref.

Descriptors: *Brazil, *Land management, *Land use, *Rainfall-runoff relationships, *Sediment erosion, *Semiarid lands, *Soil erosion, *Surface runoff, Catchment areas, Erosion rates, Sediment discharge, Sediment sampler, Sediment transport, Sediment yield, Sediments, Slopes, Vegetation effects, Water level recorders.

The effects of land use, slope, and vegetal cover in the region of Sume, Brazil, on surface runoff and land erosion are not known quantitatively. This information would be of great importance in land use management of small basins and could serve as a very useful input in the regional planning process. To evaluate the influence of such factors on the sediment production rates, several experimental plots of 100 sq m and four microbasins were installed within the representative basin of Sume. All basins were equipped with sediment collectors, automatic water level recorders, and means for collecting a cumulative suspended sediment sample. The erosion plots were submitted to different slopes, vegetal cover, and management. Measurements of surface runoff and soil erosion have been carried out since 1982. The results show the large influence of natural vegetation on surface runoff and erosion. In the case of the nonvegetated microbasins, there was a large concentration of

events with low yields of sediments and very few events with a production of more than 1600 kg/ha. In general it was found that the natural vegetation reduced the surface runoff and erosion by 90% or more for events of less than 50 mm of rain. The soil loss per unit area proved to be higher in the case of erosion plots than in the microbasins of similar characteristics. The precipitation-runoff relationships as well as soil loss (erosion) and erosivity index showed far less scatter and a better-defined trend in the case of 100 sq m plots. In the case of mulching, the average reduction of runoff, compared with bare soil conditions, was about 50% and soil loss more than 60%. The soil loss was consistently higher for the larger slope, although the runoff was the same. Similarly, the effect of contour planting reduced the erosion rates by more than 50% on the average when compared to planting along the slope. The runoff reduction was of the order of only 20%. (See also W91-07057) (Fish-PTT)
W91-07091

MEASURING SEDIMENT YIELDS OF STORMS USING PSALT.
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
R. B. Thomas.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 315-323, 1 fig, 11 ref.

Descriptors: *California, *Erosion, *Forest watersheds, *Land management, *Rainfall-runoff relationships, *Sampling, *Sediment yield, *Soil erosion, *Storm runoff, Catchment areas, Computer programs, Data acquisition, Field tests, On-site data collections, River sediments, Sediment discharge, Sediment transport, Sediments, Suspended sediments.

Storm yields of water and sediment are being measured as part of a study of the effects of roading, logging, and burning in a second-growth redwood forest in northern California. Two primary basins, each about 500 ha, and 13 sub-basins in one of them are measured for sediment flux and the presence and magnitude of sediment-based 'cumulative effects.' Study objectives require a more sophisticated sediment sampling design than is typically used in watershed experiments. Sediment is sampled and estimated by using PSALT (Piecewise Selection at List Time)--a probability-based method for sampling that enhances data collection during high flows. The method is applied to storms defined after field data are collected. The sampling sites are visited at arbitrary times during storm periods. Because PSALT data are independent they can be combined to give unbiased estimates of suspended sediment yield and its variance during storms. Application of the method to a large number of basins requires parameter adjustment to balance sampling across storms. (See also W91-07057) (Author's abstract)
W91-07092

USE OF CAESIUM-137 MEASUREMENTS TO INVESTIGATE SEDIMENT DELIVERY FROM CULTIVATED AREAS IN DEVON, UK.
Exeter Univ. (England). Dept. of Geography.
D. E. Walling, and S. B. Bradley.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 325-335, 3 fig, 24 ref.

Descriptors: *Cesium radioisotopes, *Cultivated lands, *England, *Erosion, *Isotope studies, *Land management, *Sediment transport, *Sedimentation, *Soil erosion, *Tracers, Cultivation, Deposition, Isotopic tracers, Land use, Sediment discharge, Sediments.

There is a need for empirical evidence concerning patterns of erosion and deposition on agricultural land and the proportion of the eroded sediment reaching the water courses, in order to improve understanding and prediction of sediment delivery processes. However, such information is difficult to assemble using conventional measurement techniques. It is suggested that cesium-137 measurements offer considerable potential in this context and some results of using this approach to investigate sediment delivery from cultivated areas in Devon, England, were examined. Measurements of 137-Cs activity at a number of sites within the study area characterized by hilltop locations, minimal slopes, and permanent pasture provided consistent estimates of an average baseline input of 250 mBq/sq cm. Profiles excavated from individual fields showed clear evidence of the influence of cultivation and of erosion and deposition. Depositional gains of 137-Cs-labeled sediment were consistent with continued mixing by cultivation. With a typical analytical precision of plus or minus 6% for the core samples, sampling variability is responsible for most of the overall range of the precision ascribed to the cores. These measurements enable generalized maps of the spatial distribution of erosion and deposition within cultivated fields during the past 30 years to be constructed, as well as providing evidence of the proportions of the eroded soil which are redeposited within, or transported beyond, the field. (See also W91-07057) (Fish-PTT)
W91-07093

RELIABILITY OF RATING CURVE ESTIMATES OF SUSPENDED SEDIMENT YIELD: SOME FURTHER COMMENTS.
Exeter Univ. (England). Dept. of Geography.
D. E. Walling, and B. W. Webb.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 337-350, 3 fig, 5 tab, 20 ref.

Descriptors: *England, *Error analysis, *Rating curves, *River sediments, *Sediment yield, *Suspended sediments, Estimating, Graphical analysis, Sediment discharge, Sediment transport, Sediments, Uncertainty.

A number of recent papers have suggested that the underestimation bias inherent in the use of log-transformed regression to derive suspended sediment rating relationships is a major cause of the error commonly associated with rating curve estimates of suspended sediment yield, and that this bias can be largely removed by applying simple correction factors. However, there is conflicting evidence as to the extent to which bias-corrected rating estimates provide reliable values of sediment yield. In order to investigate this uncertainty further, continuous records of suspended sediment concentration and discharge for three rivers in Devon, England, were assembled. These records were used to calculate actual loads and to synthesize a variety of replicate data sets, representing different manual sampling strategies, for rating curve derivation. The resulting load estimates obtained using rating curves and bias-corrected rating curves were compared with the actual loads. The results indicate that bias-correction procedures do not provide accurate estimates for these rivers and that other sources of error associated with rating curves are more important in producing inaccurate estimates. Further attention could be given to other approaches to improving the accuracy of rating curve estimates, including the use of regression weighted towards the high values of concentration and discharge responsible for transporting the majority of the load. However, the substantial scatter evidenced by most rating relationships and the complexities associated with hysteresis and exhaustion effects are thought to preclude any major improvements in the reliability of rating curves. (See also W91-07057) (Author's abstract)
W91-07094

PERIODICITY OF SUSPENDED SEDIMENT CONCENTRATIONS IN THE RIVER TIGRIS AT BAGHDAD IDENTIFIED USING SHORT INTERVAL SAMPLING.
Baghdad Univ. (Iraq). Dept. of Geology.
N. A. Al-Ansari, and G. T. Al-Sinawi.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 353-357, 3 fig, 2 tab, 7 ref.

Descriptors: *Iraq, *River sediments, *Sediment concentration, *Suspended sediments, *Tigris River, Agricultural runoff, Catchment areas, Deposition, Land use, Periodicity, Sediment sampling, Sediment transport.

The short-term variation of suspended sediment concentrations in the River Tigris at Baghdad, Iraq, was investigated. Samples were collected at 2-h intervals from the river at two stations upstream and downstream of the city of Baghdad for seven days. Suspended sediment concentrations were determined and their periodicity was investigated. The suspended sediment concentrations showed a mean value of 182.5 mg/L at the upstream station and a mean of 86.6 mg/L downstream. It was concluded that agricultural activity upstream of Baghdad increased the concentration of suspended sediments causing short period cycles. The deposition of sediment along the reach of the river within the city causes a decrease in concentrations and diminishes the short period cycles downstream. (See also W91-07057) (Fish-PTT)
W91-07095

EVALUATION OF THE RISKS OF EROSION AND SEDIMENTATION IN BRAZIL FROM ROUGH SEDIMENT BUDGETS (EVALUATION DES RISQUES D'EROSION ET DE SEDIMENTATION AU BRESIL A PARTIR DE BILANS SEDIMENTOLOGIQUES RUDIMENTAIRES).
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
M. P. Bordas, A. E. Lanna, and F. R. Semmelmann.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 359-368, 1 fig, 3 tab, 3 ref. English summary.

Descriptors: *Brazil, *Risk assessment, *Sediment erosion, *Sediment transport, *Sedimentation, *Suspended sediments, Gaging stations, Hydraulic structures, Land management, Sediment discharge, Sedimentary basins, South America.

In Brazil, the importance of problems caused by sedimentation has only relatively recently been recognized. Preliminary estimation of such risks has therefore been attempted, using the 'sediment budget' concept. The estimation of the risks of erosion and sedimentation is proved feasible, in Brazil, by the use of a simplified sediment budget, based on data of generally mediocre quality. Although insufficient in many ways, the data collected in the Brazilian sediment-measurement network permit the calculation of rough sediment budgets which may help detect basins prone to erosion or sedimentation problems. Using these data, simplified computations of mean concentration and minimum specific suspended sediment production permit the identification of regions where sediment problems require particular attention when designing or managing hydraulic structures. The precision of the data is sufficient to guide an eventual redeployment of the sediment gaging network and to estimate for the first time the importance of risks and the impact of sediments on the management of waters and/or soils. (See also W91-07057) (Fish-PTT)
W91-07096

SEDIMENT YIELD IN THE VELHAS RIVER BASIN (MINAS GERAIS, BRAZIL).
ELETROBRAS, Rio de Janeiro (Brazil). Dept. de Recursos Energeticos.
N. O. Carvalho.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 369-375, 3 fig, 3 tab, 3 ref.

Descriptors: *Brazil, *Erosion, *Land management, *Sediment yield, *Sedimentation, *Soil erosion, Catchment areas, Erosion control, Land use, River basins, Sediment discharge, Sedimentary basins, Sediments.

The constant increase in population, the necessity for agriculture and multifarious constructions along the Velhas River basin, a tributary of the Sao Francisco River, Minas Gerais State, Brazil, are factors of great importance which nevertheless result both in erosion of the land and degradation of the soil. A sedimentological diagnosis was made of this basin, based on the sediment discharge measurements at stations along the river. The values of sediment yield and soil degradation depth were computed and compared with standard values obtained by research in other countries. The work also included a study of the increase in sediment yield of the basin through the period 1956-1983. It was shown that the sediment yield in the Velhas River basin may be considered as moderate, but not alarming. However, the upper basin presents a sediment yield bigger than normal values encountered in the U.S. It was also shown that sediment yield has increased throughout the study period. It was concluded that there is a need for action to decrease the erosion in the basin. Some suggestions for the control of erosion and sedimentation include: laws to prevent forest exploitation, provision of incentives for reforestation, laws to prohibit the burning of field vegetation, adequate agricultural soil management techniques, laws for adequate use of appropriate earthwork, protection of slopes and uncovered areas, care and protection of catchment areas, studies of causes and risks of erosion and sedimentation, economic evaluation of erosion and sedimentation damage, and educational campaigns for local inhabitants. (See also W91-07057) (Fish-PTT)
W91-07097

ANALYSIS OF SEDIMENT YIELDS DURING THE HISTORIC PERIOD IN THE LOESS REGION OF THE YELLOW RIVER BASIN.
Yellow River Water Resource Protection Inst., Zhengzhou (China).
S. Dai.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 377-380, 1 fig, 1 tab, 2 ref.

Descriptors: *China, *Erosion, *Geologic history, *Huang He River Basin, *Land use, *Sediment load, *Sediment yield, *Sedimentation, Climatic changes, Erosion rates, Loess, Sediment transport, Sedimentary basins, Sediments.

The Lower Yellow River in China carries the largest sediment load of all world rivers; 85% of the sediment transported within the lower Yellow River is derived from the loess region of the Middle Yellow River. The major factors affecting sediment yields in the loess region are the land surface, climate, and human activity. Land surface and climate have been important throughout the geologic history of the loess region which extends back over several million years. The influence of human activity has only appeared in the historical period when human activity could affect sediment yield: over the last 4000-5000 years. The mean annual sediment yield of the Yellow River during the geological period was estimated as 380,000,000 t (much less than the 1,600,000,000 t contemporary mean annual sediment yield). The loess deposition in the Middle Yellow River began during the Quaternary period, when there were four periods of increased erosion. The third and fourth erosion periods exerted a considerable influence on sedimentation in the Lower Yellow River. In the historic period, human activities exerted a major effect on sediment yields in the loess region. According to the evidence of alluvial fan aggradation and taking into account the time factor and the linear acceleration of erosion, it was estimated that the rate of acceleration of the erosion rates during the period 1020 BC to 1194 AD should be 0.71% per hundred years, and the overall rate of acceleration of erosion rates during the period 1194 AD to 1855 AD was 1.36% per hundred years, indicating that the impact of human activity in accelerating erosion rates was greater than that of natural factors during the period 1194 AD to 1855 AD. (See also W91-07057) (Fish-PTT)
W91-07098

SUSPENDED SEDIMENT AT A CROSS SECTION OF THE MIDDLE PARANA RIVER: CONCENTRATION, GRANULOMETRY AND INFLUENCE OF THE MAIN TRIBUTARIES.
Instituto Nacional de Limnologia, Santo Tome (Argentina).
E. C. Drago, and M. L. Amsler.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 381-396, 8 fig, 5 tab, 15 ref.

Descriptors: *Parana River, *River sediments, *Sediment yield, *South America, *Suspended sediments, Catchment areas, Particle size, River basins, Sediment discharge, Sediment load, Sedimentary basins, Wash load.

The middle reach of the River Parana, integrating one of the most important fluvial systems of South America--the Rio de la Plata basin--is the subject of an ecological study to assess the likely impact of large dam construction. Based on concentrations and granulometry data of suspended sediments from the study, the origin, magnitude, annual behavior, composition, and variations of suspended material during the different river stages were investigated. It was concluded that the River Bermejo through the Lower Paraguay supplies more than 60% of the suspended material carried by the Middle Parana, and that the concentration peaks coming from that river lag behind the highest Middle Parana streamflows. The suspended sediments are composed largely of wash load, with high percentages of particles within the fine and very fine silts and clay ranges (<16 micrometers). The influence of the River Bermejo also confirms these aspects, since when the concentration peaks occur, the mean diameters, sorting, and clay percentages are closely related to those which occurred 2063 km upstream in the Bermejo Upper basin. The total suspended yield in the Middle Parana is not less than 100,000,000 t/year. (See also W91-07057) (Author's abstract)
W91-07099

ETA (EROSION TRANSPORT ACCUMULATION) SYSTEMS, THEIR CLASSIFICATION, MAPPING AND MANAGEMENT.
Vrije Univ., Amsterdam (Netherlands). Dept. of Hydrogeology and Geographical Hydrology.
G. B. Engelen, and R. G. W. Venneker.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 397-412, 10 fig, 1 tab, 3 ref.

Descriptors: *Erosion, *Hydrologic maps, *Land management, *Mapping, *Sediment transport, *Sedimentation, Catchment areas, Italy, River basins, Sediment discharge, Sedimentary basins, Systems analysis.

A regional, distributed systems approach for the transport of sediment in basins has been developed, based on the causal relationships and patterns in the chain Erosion-Transport-Accumulation (ETA). Thus ETA systems can be defined, mapped, and documented on the basis of their transporting agents: wind, water, snow, ice, gravity, and man. ETA systems have an inherent logic in space and time, following sediment from source areas to its temporary or final accumulation areas, differentiated according to scale and the practical problems to be solved. The methodology is applicable at any scale of time and space. The systems can be: (1) inactive fossil systems, called paleo-ETA systems; (2) active, recent systems, called actuo-ETA systems; and (3) to-be-active, future systems, called futuro-ETA systems. ETA processes result in associated erosion, transport, and accumulation features to be observed and measured in field surveys and be remote sensing. A stepwise procedure for the strategy to manage the ETA systems of an area can be based on ETA systems maps. Examples based on detailed field surveys were examined for the alpine basin of the Upper Boite River (approximately 200 sq km) in the Ampezzan Dolomites in northern Italy. The original detailed ETA systems map at a scale of 1:25,000 of the Upper Boite basin could be used to compile a map of the actual, present source areas of sediment, and to indicate critical positions in the surface water network where headward erosion should be stopped or prevented by the construction of drop structures in the channels. (See also W91-07057) (Author's abstract) (Fish-PTT)
W91-07100

LAKE-CATCHMENTS: AN EVALUATION OF THEIR CONTRIBUTION TO STUDIES OF SEDIMENT YIELD AND DELIVERY PROCESS.
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
I. D. L. Foster, J. A. Dearing, and R. Grew.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 413-424, 4 fig, 37 ref.

Descriptors: *Catchment areas, *Lake basins, *Model studies, *Sediment yield, Case studies, Erosion rates, Fluvial sediments, Geologic history, Geomorphology, Hydrologic models, Lake management, Land management, Sediment discharge, Sediment erosion, Sediment transport, Sedimentary basins.

Hydrologists and fluvial geomorphologists are frequently concerned with the perceived instability of catchment systems responding to land use change. Such instability is reflected in changing sediment yields, often as a result of changes to the sediment delivery process. Many hydrological studies have been instigated in forested and urban basins, for example, to quantify the magnitude and direction of change. There is a fundamental problem in matching methodological and conceptual frameworks in order to examine change in fluvial systems. Most models of change can only partially be tested through contemporary process studies. The most significant problem lies with selecting the appropriate timescale of system response and recovery and providing data at that timescale. With reference to a number of case studies, it is suggested that the lake-catchment approach provides an opportunity for: reconstructing erosion rates for the Holocene period against which contemporary accelerated rates of erosion can be evaluated; defining the magnitude and frequency of sediment transport over hydrologically and geomorphologically relevant timescales; testing models of landscape response and recovery by choosing sites which permit hypothesis testing through historical enquiry; extending the power of paired and multiple catchment experiments by providing an historical dimension to hydrological change and system response; evaluating concepts of geomorphic effectiveness through an ability to reconstruct sediment sources and delivery ratios through time; and identifying the components of system change in response to a variety of external forcing variables such as climatic change and human impacts on hydrological systems. (See also W91-07057) (Fish-PTT)
W91-07101

AVERAGE LONG-TERM SEDIMENT DISCHARGE INVESTIGATIONS BASED ON RESERVOIR RESURVEY DATA AND SEDIMENT YIELD RATE FACTORS.
Fundacao Centro Tecnologico de Minas Gerais (Brazil).
E. P. Garcia, and F. O. Vignoli.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 425-429, 2 tab, 4 ref.

Descriptors: *Brazil, *Land management, *Reservoir sediments, *Sediment discharge, *Sediment transport, *Sediment yield, Catchment areas, Erosion rates, Land use, River basins, Soil conservation, Surface runoff.

The amount of sediment moving in a stream at a given site and at a given time is a function of a complicated set of active and passive forces acting on the drainage basin upstream from the site, involving erosion and transport capacities of rainfall runoff. An investigation of these processes, based

on resurveys of existing reservoirs, was made in the state of Minas Gerais, Brazil. Comparisons and adjustments were made based on sediment yield rate factors such as rainfall, soil type, topography, land use, and drainage area size. The result was a tentative regional expression which correlates all of these factors. The sediment yield rates in all the basins studied were found to be consistent with a predatory land use due to deforestation, use of fire followed by shifting cultivation, non-controlled cattle raising, and absence of soil conservation measures. It is strongly recommended that corrective measures be implemented to control sediment yield rate by acting on cropping management and conservation practice factors. Further investigations and appropriate reservoir resurvey data are considered essential to improve the understanding of the sediment delivery system. (See also W91-07057) (Fish-PTT)
W91-07102

COMPARISON OF THE SEDIMENT TRANSPORT AND YIELD CHARACTERISTICS OF TWO ADJACENT GLACIER BASINS, VAL D' HERENS, SWITZERLAND.
Southampton Univ. (England). Dept. of Geography.
A. M. Gurnell, J. Warburton, and M. J. Clark.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 431-441, 4 fig, 8 ref.

Descriptors: *Glacial sediments, *Glacial streams, *Glaciohydrology, *Sediment sources, *Sediment transport, *Sediment yield, *Switzerland, Bed load, Catchment areas, Sediment discharge, Sediment load, Sedimentary basins, Slopes, Suspended sediments.

There are few alpine glaciated basins for which a long term suspended sediment record is available, but from the limited published information it appears that their suspended sediment yield is above the global average (when standardized for catchment area) in spite of the temporally restricted period of runoff production. Studies of the bed load yield are even more rare than studies of suspended load. Field calibrations were performed on sediment purging structures operated as part of the water intake works for a hydroelectric plant in southern Switzerland, permitting estimation of both suspended sediment and bed load yield over prolonged periods. These estimates were used with more traditional monitoring techniques to characterize and explain differences in sediment yield from two adjacent glacier basins. The basins of Glacier de Tsidjiore Nouve and Bas Glacier d'Arolla yield different quantities of suspended sediment and bed load at different time scales. Total sediment yield from the Tsidjiore Nouve basin is higher but the proportion of the bed load is lower than Bas Arolla. The contrasts in patterns of sediment yield may be caused by differences in the slope of the proglacial zone and the glacier bed below the ablation zone and associated differences in the stability of the glacial drainage system. The Tsidjiore Nouve proglacial zone is steeper than that of the Bas Arolla basin and its proglacial stream issues from various locations at the glacier snout, whereas the slope of the Bas Arolla has remained stable and such movement of the main Bas Arolla stream is rare. Adjustments in the subglacial drainage network of the Tsidjiore Nouve generates a more marked response in suspended sediment concentration to variations in discharge; limitation of suspended sediment supply becomes progressively evident through the ablation season, whereas it appears to be almost always present in the Bas Arolla basin until higher level sediment sources become active later in the ablation season. (See also W91-07057) (Fish-PTT)
W91-07103

SEDIMENT DISCHARGE FROM THE ANDES TO THE AMAZONIA ALONG THE BENI RIVER (EXPORTATION DE MATIERES EN SUSPENSION DES ANDES VERS L'AMAZONIE PAR LE RIO BENI, BOLIVIE).
Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, La Paz (Bolivia). Mission ORSTOM en Bolivie.
J. L. Guyot, J. Bourges, R. Hoorelbecke, M. A. Roche, and H. Calle.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 443-451, 6 fig, 3 tab, 10 ref. English summary.

Descriptors: *Amazon River Basin, *Andes Mountains, *Bolivia, *Sediment discharge, *Sediment transport, Beni River, Catchment areas, Erosion rates, River basins, Sedimentary basins, Suspended sediments.

An evaluation of the suspended sediment quantities and characterization of the sediment export regime of the Rio Beni has been made in Bolivia. With a 282,000 sq km area and a 9,300 cu m/s mean discharge, the Rio Beni is, with the Rio Mamore, one of the most important rivers which forms the Rio Madeira. A large part of the Beni River drainage basin (40%) lies in the Andes Eastern Cordillera. At the foothills of the Andes the sediment discharge of the Rio Beni is 191,000,000 t/year. The Rio Beni, at its confluence with the Rio Mamore and with the supply of its main affluents, carries 149,000,000 t/year of sediment to the Rio Madeira. It amounts to a global mechanical erosion rate of 527 t/sq km/year for the whole drainage basin. (See also W91-07057) (Author's abstract)
W91-07104

SIMULATION MODEL FOR THE COMPUTATION OF SEDIMENT YIELD DUE TO UPLAND AND CHANNEL EROSION FROM A LARGE BASIN.
Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. for Hydromechanics.
V. Hrissanthou.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 453-462, 2 fig, 1 tab, 11 ref.

Descriptors: *Catchment areas, *Channel erosion, *Erosion, *Model studies, *Sediment discharge, *Sediment transport, *Sediment yield, Channel flow, Germany, Rainfall-runoff relationships, Reservoir sediments, Sedimentary basins, Simulation analysis, Soil erosion, Suspended sediments.

A mathematical simulation model for the computation of sediment yield due to upland and channel erosion from a large basin on a daily basis has been developed. The model was tested with suspended load data obtained at the inlet of the Forggensee Reservoir (Bavaria, Germany), i.e., at the outlet of the corresponding basin (approximately 1500 sq km), from 1966 to 1977. For more detailed calculations of the sediment yield the basin was divided into natural sub-basins. Components of this model are the Universal Soil Loss Equation (USLE) used to compute soil detachment in each sub-basin, a rainfall-runoff model used to estimate the runoff parameters of the USLE, the concept of overland flow sediment transport capacity used to compute sediment transported to the main channel of each sub-basin and the concept of channel flow sediment transport capacity used to compute sediment transported from one sub-basin to the next sub-basin. The ratios of the computed annual values of sediment yield associated with upland and channel erosion, to the measured values of sediment yield at the outlet of the whole basin ranged from 0.88 (1970) to 5.30 (1972). A sensitivity analysis showed that rainfall amount and sub-basin area strongly affect daily sediment yield at the outlet of the whole basin. The results are satisfactory considering the large basin area and the fact that the computation was performed on a daily basis and that no rainfall, runoff, or sediment yield data were available for the sub-basins. These results are much better than those obtained for the example when only upland erosion was taken into account and the whole basin was subdivided into subareas by means of a quadrangular grid. (See also W91-07057) (Fish-PTT)
W91-07105

CHANGES IN THE SEDIMENT OUTPUT OF TWO UPLAND DRAINAGE BASINS DURING FORESTRY LAND USE CHANGES.
Institute of Hydrology, Balquhidder, Lochearnhead, Scotland.
R. C. Johnson.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 463-471, 3 fig, 2 tab, 9 ref.

Descriptors: *Erosion, *Forestry, *Land use, *Scotland, *Sediment discharge, *Sediment transport, *Vegetation effects, Catchment areas, Deforestation, Environmental impact, Land management, Reforestation, Sedimentary basins, Sediments.

As part of an experiment to investigate the environmental impact of forestry at Baquhidder in upland Scotland, sediment discharges were monitored during the felling of a coniferous forest in one basin and plowing/planting in another. Sediment sampling techniques included the determination of an optimal sampling point. The influence of different sediment generating processes on the supply of mobile material was assessed by determining seasonal influences. Average annual yields prior to the land use changes were 56 t/sq km from the forested basin and 37 t/sq km from the moorland basin. For the period after the land use changes, loads increased by 5 and 3 times, respectively. Sediment sources appear to be greatly influenced by the vegetation cover, with a close forest canopy providing shelter against frosts, intense rain and surface drying, as illustrated by the seasonal differences between the basins. Frosts have more influence in the moorland basin, so that the availability of sediment is increased in winter and spring. Surface drying is more frequent in the moorland basin so that summer availability becomes irregular depending on these drying periods followed by intense summer rainfall. Sources are now dominated by forestry roads and plow furrows. These results show how sensitive the Scottish uplands are to a major land use change such as forestry. (See also W91-07057) (Fish-PTT)
W91-07106

US NATIONAL PROJECT TO DEVELOP IMPROVED EROSION PREDICTION TECHNOLOGY TO REPLACE THE USLE.
Agricultural Research Service, Tucson, AZ.
L. J. Lane, D. L. Schertz, E. E. Alberts, J. M. Laflen, and V. L. Lopes.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 473-481, 25 ref.

Descriptors: *Hydrologic models, *Land management, *Model studies, *Sediment transport, *Soil erosion, *Universal soil loss equation, Catchment areas, Cropland, Erosion, Overland flow, Prediction, Rill erosion, Sediments, Sheet erosion, Surface runoff.

Recent advances in hydrology, soil science, erosion mechanics, and computer technology have provided the technological basis for development of process-based erosion prediction technology. Concurrent trends in user requirements for erosion prediction have called for increased sophistication in the ability to predict soil erosion under a wide variety of land use and management practices. These applications include circumstances beyond the ability of current prediction technology as represented by the Universal Soil Loss Equation (USLE). Recently the US Department of Agriculture formulated a national project to develop an improved erosion prediction technology to replace the USLE. The USDA Water Erosion Prediction Project (WEPP) is designed to produce a prototype, computer-based erosion prediction technology by 1989 with a fully developed and implemented version in use by 1992. The WEPP erosion prediction technology is to apply to 'field-sized' areas ranging in size from a single hillslope up to perhaps a few hundred hectares, where overland flow and surface runoff are predominant. The procedures are to compute sheet and rill erosion associated with overland flow and concentrated flow erosion in natural and constructed waterways in croplands, rangelands, and disturbed forest areas across the US. The basic concepts incorporated

into the model include: storm erosivity, overland flow routing, development of the runoff hydrograph, hydraulic relationships, and interrill erosion processes. A very large and extensive program of field experiments is under way to estimate the model parameters on croplands and on rangelands. These model parameters are in turn being related to soil properties. (See also W91-07057) (Fish-PTT)
W91-07107

STUDY OF THE TOTAL LOAD TRANSPORT BY THE YELLOW RIVER.
Yellow River Conservancy Commission, Zhengzhou (China). Inst. of Hydraulic Research.
B. Lin, and Y. Long.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 483-496, 7 fig, 5 tab, 12 ref.

Descriptors: *China, *Huang He River Basin, *River sediments, *Sediment load, *Sediment transport, Bed load, Catchment areas, Error analysis, Sediment sampling, Suspended sediments.

It is well known that the Yellow River in China transports a very high sediment load. Analysis of data obtained from field measurements revealed considerable discrepancies in the amount of deposition computed by the range survey method and from the difference between the sediment load at the two end sections of a river reach. The results obtained from range surveys are consistent with actual river conditions and are relatively more reliable than those obtained from the load difference method. Differences between the two methods are mainly caused by errors in the measurement of sediment load related to the 'unsampled load' which includes both the unsampled suspended load and bed load. In order to overcome this problem, studies have been undertaken to develop a method suitable for computing total sediment load in the Yellow River. (See also W91-07057) (Author's abstract)
W91-07108

MODELLING SEDIMENTATION PROCESSES IN SMALL WATERSHEDS.
Agricultural Research Service, Tucson, AZ. Aridland Watershed Management Research Unit.
V. L. Lopes, and L. J. Lane.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 497-508, 4 fig, 2 tab, 10 ref.

Descriptors: *Mathematical models, *Model studies, *Sediment yield, *Sedimentation, *Small watersheds, Entrainment, Experimental basins, Overland flow, Rainfall impact, Rainfall-runoff relationships, Sediment transport, Soil erosion.

Attempts to model sedimentation processes as they naturally occur in small watersheds is seriously constrained by the complexity of an open system with component processes and state variables that may change rapidly in space and time. A physically-based, event-oriented, mathematical model of small watershed sedimentation has been developed. The unsteady and spatially varying sedimentation processes on overland flow areas and in small concentrated flow systems are described dynamically using simultaneous rates of sediment entrainment and deposition rather than the conventional approach using steady state sediment transport functions. The model was tested using sediment yield data from rainfall simulator plots and from two small experimental watersheds. The agreement between the simulated watershed response and the observed watershed response indicates that the governing equations, initial and boundary conditions, and structural framework of the model can satisfactorily describe the physical processes of sediment generation, transport, and deposition in small watersheds. The source (entrainment) and sink (settlement) terms for the equations describing conservation of sediment mass in overland flow areas and in concentrated flow systems are mathematically consistent and incorporate appropriate initial and boundary sediment concentrations. The fact that the entrainment-by-rainfall term has a behavior similar to the entrainment-by-shear-stress term makes it evident that unique parameter identification may not be possible with the rainfall simulator data used. Perhaps, a better way to estimate these parameters is using runoff/sediment data from small plots (with detachment by raindrop impact only) to estimate the soil erodibility parameter for raindrop impact, and using data from large plots with preformed rills to estimate the soil erodibility parameter for runoff. (See also W91-07057) (Fish-PTT)
W91-07109

TRANSPORT OF SUSPENDED AND DISSOLVED MATTER IN LARGE RIVERS IN INTERTROPICAL REGIONS: PRELIMINARY RESULTS IN THE BASIN OF THE RIVER CONGO (TRANSPORT DE MATIERE SUR LES GRANDS FLEUVES DES REGIONS INTERTROPICALES: LES PREMIERS RESULTATS DES MESURES DE FLUX PARTICULAIRES SUR LE BASSIN DU FLEUVE CONGO).
Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, Montpellier. Centre de Montpellier.
J. C. Olivry, J. P. Bricquet, J. P. Thiebaux, and N. Sigha.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 509-521, 5 fig, 19 ref. English summary.

Descriptors: *Congo River, *Congo River Basin, *Dissolved load, *River sediments, *Sediment transport, *Solute transport, *Suspended load, *Suspended sediments, Africa, Catchment areas, Erosion rates, Sediment discharge, Sediment sampling, Zaire.

The Congo River in Zaire, Africa, is the second largest major river in the world after the Amazon River in South America (mean discharge: 41,000 cu m/s, area 3,700,000 sq km). A large scientific program in the Congo basin follows the fluctuations of the suspended and dissolved matter fluxes and would characterize the mechanical and biogeochemical erosion with hydroclimatological regimes in the equatorial ecosystems. Measurements were made on the Congo at Brazzaville and Ubangui at Bangui (the major northern tributary). The estimate of the suspended load was based on a large and representative sampling. The first measurement (1987) gave a sediment discharge of 31,000,000 t/year for the Congo, 2,900,000 t/year for the Ubangui (30% and 43% of matter transport, respectively). The mechanical erosion rate was 8.9 and 6 t/sq km/year, respectively. Concentrations were between 15 and 30 mg/L for the Congo, and between 3 and 55 mg/L for the Ubangui. These values are lower than previously-published results for the Congo and very small compared with figures for the Amazon (11% for erosion rate, 5% for sediment discharge). (See also W91-07057) (Author's abstract)
W91-07110

UNCERTAINTIES IN DEFINING THE SUSPENDED SEDIMENT BUDGET FOR LARGE DRAINAGE BASINS.
Geological Survey, Denver, CO.
R. S. Parker.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 523-532, 3 fig, 1 tab, 8 ref.

Descriptors: *Missouri River, *Path of pollutants, *River sediments, *Sediment budget, *Sediment transport, *Suspended sediments, *Uncertainty, Catchment areas, Error analysis, Missouri, Nebraska, Sediment discharge, South Dakota.

Toxic material transported in association with suspended sediment has increased interest in the sediment budgets of large rivers and has emphasized concerns about uncertainties in these accounting methods. A sediment budget within a reach can be defined as a closed system by considering the measured sediment transport from upstream, from intervening tributaries, and from the outlet of the reach. The residual in this calculation is sediment that is eroded or deposited in the reach, although natural variability may cause this residual to be masked by error. A study was made of the sediment data for the Missouri River and its principal tributaries from Yankton, South Dakota, downstream to Hermann, Missouri, near the confluence with the Mississippi River. Within this reach suspended sediment load increases in the Missouri River from about 1.1 million t/year (1957-1968) to about 80 million t/year (1957-1981) primarily from the addition of material from intervening tributaries. It was found that, on the Missouri River main stem, the standard errors of mean annual suspended-sediment discharge increased in a downstream direction. Tributaries had greater standard errors for the mean annual values than main stem stations. In the reach between Omaha, Nebraska, and Nebraska City, Nebraska, the variance in the residual term of the sediment budget accounted for 13% of the mean sediment discharge at Nebraska City. (See also W91-07057) (Author's abstract)
W91-07111

MORPHOLOGICAL CONTROLS ON SEDIMENT DELIVERY PATHWAYS.
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
K. L. Prestegaard.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 533-540, 7 fig, 10 ref.

Descriptors: *Channel morphology, *Geomorphology, *Pennsylvania, *River sediments, *Sediment erosion, *Sediment transport, *Sediment yield, Catchment areas, Flood plains, Gullies, Sediment discharge, Sedimentary basins, Suspended sediments.

Sediment budgets can be used along with morphological measurements of sediment delivery pathways to determine systematic variations in sediment sources that occur with changes in basin area. A study of the Pequea Creek basin in southeastern Pennsylvania, shows that the sediment yield per unit area remains almost constant in the downstream direction. An examination of the morphological controls of sediment yields suggests that there is a decrease in the delivery efficiency of gullies in the downstream direction, but that bank erosion maintains or slightly increases its effectiveness. The frequent flooding of the channel flood plains in the downstream reaches of the basin increases the amount of sediment that can be stored in the flood plain. These results indicate that it is not likely that sediment stored in the lower basin will simply migrate downstream. The stream gradient steepens downstream prior to entering the Susquehanna River. Sediment on the streambed and in suspension is transported through to the Susquehanna once it reaches these steep reaches. (See also W91-07057) (Fish-PTT)
W91-07112

CHANNEL SEDIMENT BEHAVIOUR AS A BASIS FOR MODELLING DELIVERY PROCESSES.
New South Wales Univ., Kensington (Australia). School of Geography.
W. A. Rieger, L. J. Olive, and C. J. Gippel.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 541-548, 1 fig, 20 ref.

Descriptors: *Australia, *Channel morphology, *Erosion, *Model studies, *River sediments, *Scour, *Sediment discharge, *Sediment transport, Catchment areas, River basins, Sediment concentration, Slopes, Storm runoff, Surface runoff.

Past research on erosion processes within river basins has concentrated either on the actual processes operating on the basin slopes based on the sub-basin level, or on sediment yield as a result of all the erosional processes operating on the basin slopes. The two approaches differ according to scale and in modeling erosion processes. An at-

tempt has been made to use the response of sediment concentration to discharge during storm events in five small, adjacent basins in the southeast of New South Wales, Australia, to differentiate some factors which may be contributing to sediment delivery from the slopes to the channel. Analysis of the storm event sediment response patterns showed both a spatial variation in response and sediment depletion throughout a storm. These could be explained by source areas of surface runoff within basins and the related effect of soil moisture conditions and pH of the transport medium on particle mobility. This indicates how channel behavior can form the basis for determining specific areas of a basin which might be important to modeling the delivery process. (See also W91-07057) (Fish-PTT)
W91-07113

ESTIMATION OF COLLUVIAL RESERVOIR LIFE FROM SEDIMENT BUDGETING, KATIORIN EXPERIMENTAL BASIN, KENYA.
Toronto Univ. (Ontario). Dept. of Geography.
R. A. Sutherland, and R. B. Bryan.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 549-560, 3 fig, 2 tab, 21 ref.

Descriptors: *Erosion, *Kenya, *Land management, *Reservoir sediments, *Reservoir silting, *Sediment budget, *Sediment transport, Africa, Colluvial soils, Entrainment, Erosion rates, Experimental basins, River basins, River sediments, Sediment discharge, Soil erosion.

Soil erosion and fluvial transport have been studied in Africa for more than 50 years. However, little is known about the local transfers or storages of material within drainage basins. Field studies of sediment entrainment, storage, and transport in channel systems within a small, semiarid Kenyan drainage basin (0.30 sq km) have been in progress since 1984. The study area was subject to overgrazing, drought, and locust invasions in the 1920s and 1930s. Field experiments were carried out during 1986 to quantify the total amount of sediment within the colluvial-hillslope zone of the Katiorin basin, and to determine the net change in storage within this reservoir using a sediment budget approach. These data were necessary to assess erosion rates in the study basin. Results indicated a net sediment loss of 6150 t/sq km/year from the colluvial reservoir during 1986. Once the material reached the channel network, it was efficiently removed from the basin. Results suggest that at current rates of colluvium loss, 70% of the Katiorin basin will approach colluvial exhaustion in 150 years. The sediment budget approach is of great practical value, since it identifies the most significant areas of sediment loss and areas where rehabilitation measures should be implemented. (See also W91-07057) (Author's abstract) (Fish-PTT)
W91-07114

EROSION, TRANSPORT AND DEPOSITION OF SEDIMENTS BY THE TROPICAL RIVERS OF INDIA.
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
P. Vaithiyanathan, A. Ramanathan, and V. Subramanian.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 561-574, 9 fig, 4 tab, 21 ref.

Descriptors: *Erosion, *India, *River sediments, *Sediment transport, *Sedimentation, *Sedimentation rates, *Tropical regions, Catchment areas, River basins, Sediment discharge, Sediment load, Sediment yield, Suspended sediments.

Over the past two or three decades growing awareness of the wide-ranging environmental significance of suspended sediment transport by rivers has generated a considerable body of information concerning the magnitude of sediment yields and their control by human activity, climate, and other catchment characteristics. Some major tropical rivers of India (the Cauvery, Krishna, and Godavari) were sampled to characterize their sediment transport. On the basis of these observations their sediment loads were computed and compared with those of the major rivers of the world. Monthly and annual variations in sediment transport as a function of time and space were observed. The mean annual sediment transport of the Godavari, Krishna, and Cauvery were estimated to be 170, 4, and 1.5 million tons, respectively. The bulk of the sediment transport (>95%) takes place within a three month segment of the monsoon period. The size distribution data for suspended sediment in the Godavari River indicate that the relative contribution of the different grain sizes to annual sediment load ranges from 23 to 2% for coarse, from 30 to 5% for medium, and from 87 to 49% for fine sediment. Mineralogically, the suspended sediment of these rivers is characterized by an abundance of montmorillonite with minor amounts of illite, kaolinite, and chlorite. Rates of sedimentation in sediment cores collected from the deltaic region of the river basins were determined by the excess 210-Pb technique. Sediment deposition rates of 1.1 cm/year for the Krishna River and 0.35 cm/year for the Cauvery River were obtained. (See also W91-07057) (Author's abstract)
W91-07115

SEDIMENT YIELD AND AVAILABILITY FOR TWO RESERVOIR DRAINAGE BASINS IN CENTRAL LUZON, PHILIPPINES.
Hydraulics Research Ltd., Wallingford (England). Overseas Development Unit.
S. White.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 575-581, 3 fig, 1 tab, 6 ref.

Descriptors: *Land management, *Philippines, *Reservoir sediments, *Sediment transport, *Sediment yield, *Sedimentation, Catchment areas, Cyclones, Erosion rates, Feasibility studies, Prediction, River sediments, Sediment concentration, Sediment discharge, Soil erosion, Storm runoff.

Studies of two drainage basins in central Luzon, Republic of the Philippines, have been carried out by the British Overseas Development Unit of Hydraulics Research in collaboration with the National Irrigation Administration, Manila. The projects have involved the measurement of sediment transport in rivers in order to assess sediment yield to the existing Magat reservoir and the one planned for Casecnan. In the Magat basin, measurements have also been made of soil loss from small, reforested areas and of sedimentation in the reservoir. The data collected so far have shown the overwhelming importance of cyclone events in the sediment transport process. One of these events can carry more sediment than the sum of all non-flood flows for the year. These high discharges are the most difficult in which to monitor sediment transport. There is, however, evidence of a 'cut-off' in sediment concentrations at high discharge, indicating an availability constraint on sediment yields. At the same time information is being amassed to show that sedimentation rates at Magat may be approximately twice those assumed during the feasibility study. Before construction of the Magat dam, the reservoir sedimentation rate was estimated to be 5.5 million cu m/year, equivalent to a mean catchment erosion rate of 20 t/ha/year. Since impoundment, the sedimentation rate has been 11 million cu m/year, which is equivalent to a mean erosion rate of 38 t/ha/year. If this is a correct figure for reservoir sedimentation, it would mean that the useful life of the reservoir would be reduced from 100 to 25 years. Reasons for this underestimation of sediment yield may include unreliable original prediction rates based on an extremely limited data set, and the possibility of a dramatic increase in sediment yield rates after reservoir impoundment and population increase. (See also W91-07057) (Fish-PTT)
W91-07116

APPLICATION OF TWO PHYSICALLY-BASED SEDIMENT YIELD MODELS AT PLOT AND FIELD SCALES.
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
J. M. Wicks, J. C. Bathurst, C. W. Johnson, and T. J. Ward.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 583-591, 1 fig, 1 tab, 15 ref.

Descriptors: *Erodibility, *Erosion, *Model studies, *Parameter estimation, *Scale factors, *Sediment yield, *Soil erosion, Catchment areas, Experimental basins, Idaho, Sediment discharge, Sediment transport, Soil water.

A major problem in the application of physically-based soil erosion and sediment yield models is the representation of the soil's ability to withstand erosion. Two different sediment yield models (SHE and MULTSED) were used to assess the degree to which model parameters calibrated at a small spatial scale remain representative at a large scale. The test data were taken from the Reynolds Creek rangeland research basin near Boise, Idaho. At the smallest scale the water and sediment yield components of both models were successfully calibrated for 32.54 sq m rainfall simulator plots. The calibrated models were then applied to a 1 ha subbasin for four summer rainfall events. The resulting simulations were poor but were considerably improved by reasonable variations in model antecedent soil moisture contents. The poorest results were those for events for which the measured sediment/water yield ratio differed significantly from that for the simulator plots. For this study, transfer of parameter values between scales was affected more by uncertainties in the model hydraulic functions for dry soil and by differences in test conditions than by any scale effects. (See also W91-07057) (Author's abstract)
W91-07117

2K. Chemical Processes

ALTERATION OF SOIL ORGANIC MATTER BY INUNDATION.
Irkutskii Gosudarstvennyi Univ. (USSR). Inst. of Petrochemical and Coal-Chemical Synthesis.
For primary bibliographic entry see Field 2G.
W91-05978

PRELIMINARY STUDY ON THE DISTRIBUTION OF NUTRIENTS, ORGANIC MATTER, TRACE METALS IN SEA SURFACE MICROLAYER IN XIAMEN BAY AND JIULONG ESTUARY.
Xiamen Univ. (China). Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W91-06100

NEUTRON ACTIVATION ANALYSIS (NAA) AND GEOCHEMICAL STUDIES OF 38 ELEMENTS IN SURFACE SEDIMENTS FROM LOWER REACH AND ESTUARY OF HUANGHE (YELLOW) RIVER.
Academia Sinica, Qingdao (China). Inst. of Oceanology.
For primary bibliographic entry see Field 2J.
W91-06219

INTERFACIAL GEOCHEMISTRY OF BARIUM IN SUSPENSION AND SEDIMENT FROM ZHUJIANG ESTUARY.
Academia Sinica, Guangzhou (China). South China Sea Inst. of Oceanology.
For primary bibliographic entry see Field 5B.
W91-06220

WIDESPREAD OCCURRENCE OF HIGHLY BRANCHED ACYCLIC C20, C25 AND C30 HYDROCARBONS IN RECENT SEDIMENTS AND BIOTA -- A REVIEW.
Polytechnic South West, Plymouth (England). Dept. of Environmental Sciences.
S. J. Rowland, and J. N. Robson.
Marine Environmental Research MERSDW, Vol. 30, No. 3, p 119-216, 1990. 2 fig, 2 tab, 56 ref.

Descriptors: *Geochemistry, *Hydrocarbons, *Marine sediments, *Oil, *Water chemistry, Chemical analysis, Chemical properties, Lacustrine environment, Marine biology, Marine pollution, Pollutant identification, Sediments, Water pollution.

Many studies have coincidentally highlighted the occurrence of unsaturated hydrocarbons that are not attributable to pollution. Among these, a group of C20, C25, and C30 alkenes often predominate with concentrations as high as 40 microgram/g dry sediment. Few compounds in modern geochemical research can have been reported so frequently, yet remained unidentified for so long. Both acyclic and cyclic structures have been proposed and a rather confused picture has emerged. The occurrence of widely distributed acyclic isoprenoid hydrocarbons, with highly branched structures, in sediments and biota was examined. The compounds occur in young aquatic (both marine and lacustrine) sediments from many parts of the globe (Peru, Antarctica, Gulf of Suez, North Sea, Atlantic), sometimes in high concentrations relative to other hydrocarbons, as alkanes and alkenes with from one to at least four double bonds. However, the compounds rapidly disappear in older sediments, possibly due to biodegradation and reaction with sedimentary sulfur. The alkenes with more than two double bonds appear to be rapidly removed from the hydrocarbon fraction of most sediments, whereas the alkanes and monoenes seem to be more resistant to biodegradation and hence occur in some more ancient sediments and oils. There is evidence too that some of the alkenes react rapidly with sulfur to form sedimentary thiophenes that are also present in some oils and sediments. The sources of this group of hydrocarbons remain largely unknown, though evidence points to algae (possibly diatoms) as one possibility. The recent identification of related sulfur-containing compounds in a crude oil promises to extend the number of reports of these compounds still further, and to increase their importance as environmental biological markers. (Mertz-PTT)
W91-06263

PROTON CYCLE OF A DECIDUOUS FOREST ECOSYSTEM IN THE NETHERLANDS AND ITS IMPLICATIONS FOR SOIL ACIDIFICATION.
Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science.
For primary bibliographic entry see Field 5B.
W91-06317

ASPECTS OF THE NITROGEN CYCLE IN PEATLAND AND PLANTATION FOREST ECOSYSTEMS IN WESTERN IRELAND.
University Coll., Dublin (Ireland). Dept. of Environmental Resource Management.
For primary bibliographic entry see Field 2H.
W91-06321

SEASONALITY OF DENITRIFICATION IN WATER-LOGGED ALDER STANDS.
Copenhagen Univ. (Denmark). Dept. of General Microbiology.
For primary bibliographic entry see Field 2H.
W91-06322

ACID BUFFERING IN LOWLAND FORESTED ECOSYSTEMS: A CASE STUDY IN THE TRENT BASIN, UK.
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W91-06515

EFFECTS OF HYDROCHEMISTRY VARIABILITY ON WATER QUALITY SAMPLING FREQUENCIES IN AN ALPINE-SUBALPINE FOREST BASIN.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
J. D. Stednick.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 401-407, 5 tab, 4 ref.

Descriptors: *Cycling nutrients, *Forest hydrology, *Mountain watersheds, *Stream chemistry, *Water chemistry, *Water sampling, Alkalinity, Alpine regions, Calcium, Colorado, Conductivity, Forest watersheds, Hydrogen ion concentration, Magnesium, Nitrogen, Nutrient concentrations, Nutrient transport, Phosphorus, Potassium, Sodium, Streamflow, Sulfates, Water quality.

Stream sampling data are often used to calculate export or nutrient fluxes (mass/time) from watersheds. To appreciate nutrient cycling processes, input and intrasystem waters must be sampled for quantity and quality. The effects of hydrochemistry parameter variability on water quality sampling processes in an alpine-subalpine forest basin were studied. Samples of precipitation, soil water, and streamflow from Hourglass Creek in the Colorado Rocky Mountains were analyzed for pH, conductivity, alkalinity, nitrogen, phosphorus, calcium, magnesium, sodium, and potassium. Time-weighted and volume-weighted annual means were not significantly different from arithmetic mean concentrations. A minimum sample size was calculated. For precipitation, with an allowed error of plus or minus 10 percent of the annual mean at 90 percent confidence, minimum sample sizes ranged from one sample for pH, orthophosphate, magnesium, and potassium to >120 samples for conductivity, sulfate, and sodium. Streamflow had minimum sample size estimates of one sample for orthophosphate and magnesium to 45 samples for calcium and 102 samples for conductivity. (See also W91-06510) (Author's abstract)
W91-06548

EFFECT OF CLEARCUTTING ON CHEMICAL EXPORTS IN LATERAL FLOW FROM DIFFERING SOIL DEPTHS ON A SUBALPINE FORESTED SLOPE.
Forest Service, Fort Collins, CO.
For primary bibliographic entry see Field 4C.
W91-06550

DETERMINATION OF HYDROLOGICAL FLOW PATHS AND ASSOCIATED HYDROCHEMISTRY IN FORESTED CATCHMENTS IN CENTRAL SCOTLAND.
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 5B.
W91-06551

IMPACT OF CONIFER AFFORESTATION ON WATER QUALITY IN AN UPLAND CATCHMENT IN SOUTHWEST ENGLAND.
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
For primary bibliographic entry see Field 5C.
W91-06552

INFLUENCE OF SEASON ON THE BREAKDOWN OF SUBMERGED LEAVES.
Mohamed-1 Univ., Oujda (Morocco). Dept. de Biologie.
For primary bibliographic entry see Field 2H.
W91-06751

CHEMICAL HYDROLOGY AND MACROPHYTE VEGETATION IN THE CANALS OF A MEDITERRANEAN COASTAL MARSH.
Universitat de les Illes Balears, Palma de Mallorca (Spain). Dept. de Biologia y Ciencias de Salud.
For primary bibliographic entry see Field 2L.
W91-06755

HCO3(-) AS AN EXOGENOUS CARBON SOURCE FOR RUPPIA CIRRHOSA (PENTAGNA) GRANDE.
Institut de Recerca i Tecnologia Agroalimentaries, Barcelona (Spain).
For primary bibliographic entry see Field 2H.
W91-06756

EFFECTS OF SOIL FAUNA ON LEACHING OF NITROGEN AND PHOSPHORUS FROM EXPERIMENTAL SYSTEMS SIMULATING CONIFEROUS FOREST FLOOR.
Jyvaeskylae Univ. (Finland). Dept. of Biology.
H. Setala, E. Martikainen, M. Tyynismaa, and V. Huhta.
Biology and Fertility of Soils BFSOEE, Vol. 10, No. 3, p 170-177, 1990. 2 fig, 3 tab, 33 ref.

Descriptors: *Forest soils, *Leaching, *Nitrogen, *Nutrient transport, *Phosphorus, *Soil organisms, Ammonium, Conifers, Decomposing organic matter, Invertebrates, Laboratory methods, Litter, Microorganisms, Mineralization, Phosphates, Soil analysis, Soil environment, Soil tests.

In order to study the effect of two structurally different decomposer communities on nitrogen (N) and phosphorus (P) mineralization, long-term experiments (97 to 98 weeks) were carried out in macrocosm systems simulating the complexity of coniferous forest soil. The macrocosms were partially sterilized by freezing, thawing and drying, then re-inoculated with microbes alone or microbes and soil fauna. Removable microcosms containing birch litter, spruce litter, or humus were inserted into the substrate humus in the macrocosms. Two experiments used organic matter only, and in the third there was mineral soil below the humus. The macrocosms were incubated in climate chambers that simulated both summer and winter conditions. At 4 to 6-week intervals the substrates were irrigated for analysis of pH, total nitrogen, ammonium-N, nitrate-N, and phosphate-P in the leachates. At the end of each growing season a destructive sampling was performed, including analyses of potassium chloride-extractable N and P. Leaching of ammonium and phosphate ions from both the litter and the total systems was significantly enhanced by the soil fauna. There were also differences in mineralization of N and P between the refaunated systems, apparently due to divergent development of the faunal communities. In general, fauna affected KCl-extractable nutrients from the litter positively, although this effect was less evident than in the leachate. In the humus and mineral soil the fauna significantly increased the release of N and P, especially in the later stages of the experiments. Soil pH was higher in the presence of fauna, but there was no difference in the pH of leachates. Not only invertebrate-microbial interactions, but also mutual relationships among fauna were important in the nutrient dynamics. (Author's abstract)
W91-06786

DENITRIFICATION WITH DIFFERENT SIZES OF SOIL AGGREGATES OBTAINED FROM DRY-SIEVING AND FROM SIEVING WITH WATER.
Guelph Univ. (Ontario). Dept. of Land Resource Science.
For primary bibliographic entry see Field 2G.
W91-06787

INFLUENCE OF PLANTATION FORESTRY ON THE PH AND ALUMINIUM CONCENTRATION OF UPLAND WELSH STREAMS: A REEXAMINATION.
University Coll., Cardiff (Wales). School of Pure and Applied Biology.
S. J. Ormerod, A. P. Donald, and S. J. Brown.
Environmental Pollution ENPOEK, Vol. 62, No. 1, p 47-62, 1990. 5 fig, 4 tab, 33 ref.

Descriptors: *Acid rain, *Acid streams, *Aluminum, *Ecological effects, *Fish, *Forestry, *Hydrogen ion concentration, *Vegetation effects, *Wales, Data collections, Data interpretation, Databases, Land use, Reforestation, Regional analysis, Regression analysis, Spatial distribution, Stream biota, Surveys, Toxicity, Water chemistry, Watersheds.

Previous studies relating forest presence to stream acidity and aluminum concentration were based on small numbers of catchments, often precluding the elimination of confounding influences on stream chemistry, such as geology or soil type. Spatial

patterns in aluminum and pH data from 113 Welsh catchments of contrasting land use were analyzed in three different ranges of acid sensitivity (<10, 10-15, 15-25 mg CaCO3/liter total hardness). In each range, pH declined and aluminum increased significantly with increasing percentage forest cover. There was no evidence that the relationships reflected a spurious effect of forest location. Where aluminum concentrations were elevated under forest in a sub-set of 13 streams, aluminum was present predominantly in the labile form, most toxic to fish. Regressions of pH and aluminum on percentage forest cover provide a useful method of assessing the amount of forest in Welsh catchments which might give rise to given chemical conditions (e.g., pH <6, Al > 80 micrograms/liter), though some difficulties are likely in accurately specifying the conditions desirable for fish and other biota. (Author's abstract)
W91-06806

ADSORPTION OF FE(III), CO(II), AND ZN(II) ONTO PARTICULATES IN FRESH WATERS ON THE BASIS OF THE SURFACE COMPLEXATION MODEL: I. STABILITIES OF METAL SPECIES ADSORBED ON PARTICULATES.
Kyushu Univ., Fukuoka (Japan). Radioisotope Center.
S. Osaki, T. Miyoshi, S. Sugihara, and Y. Takeshima.
Science of the Total Environment STENDL, Vol. 99, No. 1/2, p 105-114, December 1990. 4 fig, 3 tab, 23 ref.

Descriptors: *Adsorption, *Cobalt, *Geochemistry, *Iron, *Metals, *Model studies, *Particulate matter, *Solute transport, *Water chemistry, *Zinc, Chemical interactions, Clays, Gels, Hydrogen ion concentration, Ions, Mass transport, Quantitative analysis, Quartz, Sediments, Silica.

Adsorption has long been considered important in the transport of elements in natural waters, and attempts have been made to quantitatively model adsorption. The surface complexation or site binding model treats adsorption sites on the surface of a solid in the same manner as dissolved ligands. A quantitative description of the adsorption of metal ions was attempted for particulates in three fresh waters on the basis of the surface complexation model. In addition, fine particles in sediment at the same sites, and three pure materials, namely quartz, silicagel, and kaolin, were examined for comparison. The concentrations of total surface sites were determined by acid titration. The results of the investigation revealed that the stabilities of Fe(III), Co(II), and Zn(II) tended to decrease from fine sediments to particulates and kaolin, and finally to silicagel and quartz. The apparent stabilities of these metal species on particulates were found to be similar to those of their citrate complexes and were slightly higher than those of their glycine complexes. (See also W91-06820) (Author's abstract)
W91-06819

ADSORPTION OF FE(III), CO(II), AND ZN(II) ONTO PARTICULATES IN FRESH WATERS ON THE BASIS OF THE SURFACE COMPLEXATION MODEL: II. STABILITIES OF METAL SPECIES DISSOLVED IN FRESH WATERS.
Kyushu Univ., Fukuoka (Japan). Radioisotope Center.
S. Osaki, T. Miyoshi, S. Sugihara, and Y. Takeshima.
Science of the Total Environment STENDL, Vol. 99, No. 1/2, p 115-123, December 1990. 4 fig, 2 tab, 13 ref.

Descriptors: *Adsorption, *Cobalt, *Geochemistry, *Iron, *Metals, *Model studies, *Particulate matter, *Solute transport, *Water chemistry, *Zinc, Chemical analysis, Chemical interactions, Chemical speciation, Dissolved solids, Ions, Manganese, Model testing, Oxidation-reduction potential, Quantitative analysis, Sediments.

The distribution of an element between the aqueous phase and a different phase depends on the relative stabilities of the element in the two phases. If these stabilities can be quantitatively described using a model, the distribution of the element can be predicted, within the constraints of the model. The concentration of an element can also be predicted on the basis of its distribution between the two phases. A study was conducted to test the applicability of the surface complexation model as a quantitative model for the distribution of metals between particulates and water in natural aqueous systems. Particulates, fine sediments, and residue from evaporation of the filtrate from fresh waters were sequentially extracted with several reagents, and concentrations of iron, manganese, cobalt, and zinc were determined. Results of the investigation revealed that concentrations of Zn(II) and Mn in particulates were higher than those found in fine sediment, and they were considerably different in their chemical speciation. The observed differences between Fe and Mn may have been due to the difference in their oxidation potentials. In addition, the difference observed between Co and Zn may have been dependent on their affinity for Fe and Mn oxides. Distributions of Fe(III), Co(II), and Zn(II) between particulates and water were determined and compared with those predicted on the basis of the surface complexation model. The results were generally consistent with theories that metal species dissolved in water exist as free ions or are considerably less stable than their surface complexes on particulates. (See also W91-06819) (Korn-PTT)
W91-06820

TRANSPORT AND SEDIMENT ACCUMULATION OF PB-210 AND CS-137 IN TWO SOUTHEAST ALASKAN FJORDS.
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2J.
W91-06835

CHEMISTRY OF ATMOSPHERIC PRECIPITATION AT THE WESTERN ARABIAN GULF COAST.
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
For primary bibliographic entry see Field 5C.
W91-06873

CONFIRMATION AND QUANTITATION OF HYDROXYMETHANESULFONATE IN PRECIPITATION BY ELECTROSPRAY IONIZATION-TANDEM MASS SPECTROMETRY.
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5C.
W91-06874

AMBIENT CONCENTRATIONS, SCAVENGING RATIOS, AND SOURCE REGIONS OF ACID RELATED COMPOUNDS AND TRACE METALS DURING WINTER IN NORTHERN MICHIGAN.
General Motors Research Labs., Warren, MI. Environmental Science Dept.
For primary bibliographic entry see Field 5B.
W91-06875

COMPOSITION OF BULK PRECIPITATION ON A COASTAL ISLAND WITH AGRICULTURE COMPARED TO AN URBAN REGION.
Vrije Univ., Amsterdam (Netherlands). Dept. of Meteorology.
For primary bibliographic entry see Field 2B.
W91-06877

VERTICAL DISTRIBUTION OF AEROSOLS AND ACID RELATED COMPOUNDS IN AIR AND CLOUDWATER.
Atmospheric Environment Service, Toronto (Ontario).
For primary bibliographic entry see Field 5B.
W91-06878

RELATIONSHIP BETWEEN PRECIPITATION AMOUNT AND WET DEPOSITION OF NITRATE AND AMMONIUM.
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5B.
W91-06879

STABILITY OF THE PH AND THE CONTENTS OF AMMONIUM AND NITRATE IN PRECIPITATION SAMPLES.
Ustredni Ustav Geologicky, Prague (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W91-06880

SITE-SPECIFIC UNDERESTIMATION OF WETFALL NH4(+) USING NADP DATA.
Kansas State Univ., Manhattan. Div. of Biology.
R. A. Ramundo, and T. R. Seastedt.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 3093-3095, 1990. 2 fig, 9 ref. NSF Grant BSR-8514327.

Descriptors: *Ammonium, *Chemistry of precipitation, *Data quality control, *Path of pollutants, *Sample preservation, *Wet deposition, Model studies, NADP wetfall collector, Nitrates, Nitrogen, Rainfall distribution, Seasonal variation, Spatial variation.

Estimates of ammonium in weekly composited wetfall samples were measured in two laboratories, one at Kansas State University and that operated by the National Atmospheric Deposition Program (NADP) in Illinois. Ammonium samples were lower in the NADP estimates and exhibited a strong seasonal difference in concentrations. Losses were likely not due to volatilization; microbial immobilization of ammonium likely occurred during transport of samples. Differences in estimates of annual ammonium ion deposition were larger than those observed for average weekly concentrations because of seasonal rainfall patterns. NADP values will require site-specific corrections for models describing or predicting regional or national patterns of nitrogen inputs in wetfall. (Author's abstract)
W91-06881

EFFECT OF SELECTED PHYSIOGRAPHIC FACTORS ON DISSOLVED GYPSUM TRANSPORT BY SIMULATED RUNOFF ON GYPSIFEROUS SOILS.
Exeter Univ. (England). Dept. of Geography.
A. Navas.
Catena, Vol. 17, No. 4/5, p 409-416, August/October 1990. 3 tab, 15 ref.

Descriptors: *Gypsum, *Runoff, *Simulated rainfall, *Soil properties, *Solute transport, *Weathering, Dissolved solids, Rainfall intensity, Slopes, Soil types, Topography, Vegetation effects.

Simulated rainfall with intensities of 48 and 58 mm/hr, representing those found in heavy storm events in the middle Ebro valley of Northeast Spain were applied to gypsiferous soils (easily susceptible to chemical weathering) of varying characteristics and slope in an attempt to assess the effect of selected physiographic factors on the transport of dissolved gypsum by runoff. The 51 field experiments carried out on 1.25 m by 1.25 m plots shed high variability in the gypsum yield among the diverse situations tested. The gypsum load transported by runoff ranged from 5 to 40/sq gm/hr. Transport of dissolved gypsum was positively related to rock outcrop and slope, and rainfall intensity produced a small dilution effect. Dry soil conditions and higher percentages of plant cover favor higher gypsum concentrations. Runoff is undersaturated in gypsum with values ranging from -1.4 to -0.3. The highest gypsum yields were recorded in Dystric Leptosols, followed by Gypsic Calcisols (lithic phase) and then Gypsic Calcisols. (Author's abstract)
W91-06909

EL NINO EFFECTS ON HYDROGEN ION CONCENTRATION OF A CALIFORNIA RESERVOIR.
California Univ., Berkeley. Kearney Foundation of Soil Science.

For primary bibliographic entry see Field 5B.
W91-06943

POREWATER OXIDATION, DISSOLVED PHOSPHATE AND THE IRON CURTAIN: IRON-PHOSPHORUS RELATIONS IN TIDAL FRESHWATER MARSHES.
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
R. O. Chambers, and W. E. Odum.
Biogeochemistry BIOGEP, Vol. 10, No. 1, p 37-52, 1990. 6 fig,1 tab, 52 ref. Virginia Sea Grant 1988 VGMSC-UVA-O.

Descriptors: *Interstitial water, *Iron, *Oxidation, *Phosphates, *Soil chemistry, *Tidal marshes, *Virginia, *Wetlands, Cores, Freshwater, Geomorphology, Moisture meters, Seepage, Subsurface water.

The process of dissolved phosphate removal from aqueous solution, which occurs during oxidation of soluble ferrous compounds to insoluble ferric forms, was examined in soils of two tidal freshwater marshes located along the Chickahominy River in Virginia. The two marshes were of different geomorphology: a frequently flooded low marsh and a less frequently flooded high marsh. Preliminary results of modeling subsurface water flow indicated that creekbanks are important sites of porewater discharge in both sites. A series of water samples was collected from reduced soils with suction lysimeters or 'sippers'. To compare creekbank porewater with seepage water, sippers were placed at depths of 10-50 cm in the creekbanks of the two marshes. Also, seepage collectors were installed at various heights along a section of creekbank of the high marsh. Soil chemistry was studied using cores from creekbank and interior areas of both marshes. Sites of amorphous iron deposition and sorption or co-precipitation of phosphate were found to be in surface soils and along creekbanks, where both ion diffusion and porewater advection move dissolved iron and phosphate from reduced to oxidized regions. Profiles of extractable iron and total phosphorus from creekbank and interior soils were consistent with hypothesized differences between a high and a low marsh. Porewater concentrations of dissolved phosphate were higher in creekbank soils of the high marsh, compared with water actually discharging from the creekbank during tidal exposure. It is proposed that an iron curtain of ferric hydroxides functions as a barrier to diffuse and advective movement of dissolved phosphate along surfaces of tidal freshwater marshes, and has important implications for the distribution and availability of phosphorus in other types of wetlands and aqueous systems. (Agostine-PTT)
W91-06944

EFFECT OF HARVEST INTENSITY AND GROUND FLORA ESTABLISHMENT ON INORGANIC-N LEACHING FROM A SITKA SPRUCE PLANTATION IN NORTH WALES, UK.
Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
For primary bibliographic entry see Field 4C.
W91-06945

METHANE PRODUCTION AND SULFATE REDUCTION IN TWO APPALACHIAN PEATLANDS.
Villanova Univ., PA. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W91-06946

SULFUR DYNAMICS IN MINERAL HORIZONS OF TWO NORTHERN HARDWOOD SOILS: A COLUMN STUDY WITH S35.
State Univ. of New York at Syracuse. Coll. of Environmental Science and Forestry.
For primary bibliographic entry see Field 2G.
W91-06948

RADIUM IN THE SUWANNEE RIVER AND ESTUARY: SPRING AND RIVER INPUT TO THE GULF OF MEXICO.
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W91-06953

IMPORTANCE OF SOIL WATER CONTENT WHEN ESTIMATING SOIL MICROBIAL C, N AND P BY THE FUMIGATION-EXTRACTION METHODS.
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 2G.
W91-06961

DENITRIFICATION IN NORTH TEMPERATE FOREST SOILS: RELATIONSHIPS BETWEEN DENITRIFICATION AND ENVIRONMENTAL FACTORS AT THE LANDSCAPE SCALE.
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 2G.
W91-06963

BIODEGRADATION OF SYNTHETIC ORGANO-METALLIC COMPLEXES OF IRON AND ALUMINUM WITH SELECTED METAL TO CARBON RATIOS.
Centre de Pedologie Biologique, Vandoeuvre-les-Nancy (France).
J.-P. Boudot, A. Bel Hadj Brahim, R. Steiman, and F. Seigle-Murandi.
Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 7, p 961-966, 1989. 6 fig, 2 tab, 34 ref.

Descriptors: *Aluminum, *Biodegradation, *Carbon, *Iron compounds, *Organometals, *Soil chemistry, *Synthetic compounds, Citric acid, Flocculation, Fulvic acids, Humic acids, Hydroxides, Incubation, Organic compounds, Podzols, Soil genesis, Soil horizons, Soil organic matter.

Synthetic organo-ferric and organo-aluminous complexes with various metal:C ratios were prepared and incubated for 44 days in an Eutrochrept A1 horizon. Citric acid was used as a model of a natural soil acid. Fungal melanins synthesized by Epicoccum purpurescens were separated in fulvic acid-like and humic acid-like polymers and used as models for naturally transformed soil organic matter. Under certain conditions, the biodegradation of such metal-organic complexes was slower than that of the free forms of the corresponding organic compounds. The intensity of this protective effect depended mainly on the metal to complexing functional groups molar ratio (M/CG) of the complexes and was also related to their aqueous solubility. For some organics, the protective effect was observed at ratios exceeding the saturation of their complexing sites, and sometimes needed a metal content exceeding more than twice their complexing capacity. In such cases, the formation of a flocculated metallic hydroxide which is trapping and wrapping the organic molecules is suggested to better account for the observed protective effect than chemical binding per se. As the solubility of the 'humic' acids decreased faster than that of the 'fulvic' ones when their metallic charge increased, the biodegradability of the humic acids decreased more rapidly than that of the fulvic acids by metal complexing. For the same reasons, citric acid was more protected by complexing Al than Fe. The protective effect of both aluminum and iron against the biodegradation of all types of organic matter was high and of a comparable intensity at high M/CG molar ratios. The present experiments are relevant to pedogenesis. Both the protective effect and the limitations against translocation processes which are characteristic of podzolic pedogenesis appear to be controlled by the flocculation of the organo-metallic associations. (Author's abstract)
W91-06965

NITROGEN DYNAMICS OF SOIL WATER IN BURNED AND UNBURNED TALLGRASS PRAIRIE.
Kansas State Univ., Manhattan. Div. of Biology.
For primary bibliographic entry see Field 2G.
W91-06966

RESOURCE QUALITY AND TROPHIC RESPONSES TO SIMULATED THROUGHFALL: EFFECTS ON DECOMPOSITION AND NUTRIENT FLUX IN A NO-TILLAGE AGROECOSYSTEM.
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 3F.
W91-06967

SOLUTE DISPERSION DURING UNSTEADY LEACHING AS AFFECTED BY AGGREGATE SIZE AND SOIL WATER CONTENT.
National Inst. of Agro-Environmental Sciences, Kannondai (Japan). Div. of Soil Science.
H. Katou, and R. Akiyama.
Soil Science and Plant Nutrition, Vol. 36, No. 1, p 53-64, 1990. 5 fig, 4 tab, 16 ref, append.

Descriptors: *Aggregates, *Dispersion, *Leaching, *Soil aggregates, *Soil water, *Solute transport, *Solutes, Chlorides, Dispersivity, Halogens, Interstitial water, Mathematical studies, Pore velocity, Soil columns.

The dispersion of chloride ion during unsteady water flow as affected by the aggregate size and soil water content was examined. Attention was paid to the vertical spreading of the solute with increasing penetration depth. Solute dispersion during unsteady leaching of chloride which had been applied as a solution was investigated in soil columns differing in aggregate size (<1 and <4 mm), initial soil water content, and the amount of leaching water applied. The approximate analytical solution of De Smedt and Wierenga (1978) for solute flow during infiltration and redistribution was extended to describe solute concentration profiles in which the water content at the solute front was different from that at the front of subsequently infiltrating leaching water. The magnitude of the solute dispersion was evaluated as the dispersivity in the solution that gave the best fit of the calculated concentration profiles to those measured. The dispersivities thus determined were consistently larger for the coarse-aggregate columns than for the fine-aggregate columns irrespective of the initial soil wetness, reflecting the more efficient leaching observed in the latter columns. In the coarse-aggregate columns chloride dispersion was more enhanced when the soil water content was lower, while the reverse was true in the fine-aggregate columns. The inefficient leaching and larger dispersivity in the unsaturated coarse-aggregate columns suggest that the solute dispersion in aggregated soils during unsaturated unsteady water flow is due mainly to the restriction of the diffusion process within the aggregates. This implies that the dispersivity in field soils will depend not only on the soil water content but also on the pore water velocity. (Author's abstract)
W91-06968

CHEMICAL PROPERTIES OF SUBSURFACE PEATS AND THEIR DECOMPOSITION KINETICS UNDER FIELD CONDITIONS.
Hokkaido National Agricultural Experiment Station, Sapporo (Japan). Peat Soil Lab.
S. Murayama, Y. Asakawa, and Y. Ohno.
Soil Science and Plant Nutrition, Vol. 36, No. 1, p 129-140, 1990. 8 fig, 7 tab, 28 ref.

Descriptors: *Decomposition, *Kinetics, *Peat, *Peat soils, *Soil chemistry, *Wetlands, Carbon, Chemical properties, Comparison studies, Compost, Field tests, Japan, Mathematical studies, Mulches, Nitrogen, Sphagnum, Straw.

The decomposability of subsurface peat in surface layer soil was examined under two different water regime conditions, i.e., upland field and wetland paddy. Samples of peat lands in Japan taken from the subsurface layers of either a non-cultivated site or cultivated fields were analyzed for the content of inorganic and organic constituents, and their decomposability in soil was examined under field conditions in upland and wetland rice fields. Samples included (1) high moor peat consisting of Sphagnum moss, (2) high moor peat consisting of Sphagnum moss and Carex middendorffii, and (30 low moor peat consisting of Carex spp. For com-

parison with the peat samples, rice and wheat straw and compost were also examined. Decomposition rate constants (k) of peats mixed with soil for a single compartment exponential decay model ranged from 0.0032 to 0.0096 (1/month), equivalent to 3.7-11% carbon loss after one year, and the decomposition was enhanced by mixing with soil. Changes in the amounts of nitrogen of the peat materials were also fitted to the model and gave rate constants (k) of 0.0015-0.0078, equivalent to 1.8-9.0% loss after 1 year, for samples mixed with soil. The decomposition of rice straw, barley straw, and compost fit a model of double compartment exponential decay. About 60% of rice straw in the paddy field and 77% of wheat straw in the upland field were decomposed as a labile fraction, respectively. The decomposition of lignin carbon accounted for the greater proportion of carbon loss from peat materials, although the decomposition rate was lower than that of saccharides. On the contrary, the decomposition of saccharides accounted for the greater proportion of the decomposition of wheat straw. (Author's abstract)
W91-06969

DETERMINATION OF SOLUBLE SELENIUM IN SOILS.
Kyoto Univ. (Japan). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 5A.
W91-06970

TOPOSEQUENCE OF FINE-TEXTURED SOILS IN THE HILLY AREA OF THE NORTHERNMOST PART OF HOKKAIDO: III. IMPORTANCE OF CHELATING LOW MOLECULAR ORGANIC ACIDS IN THE MIGRATION PROCESS OF ALUMINUM AND IRON.
Hokkaido Univ., Sapporo (Japan). Faculty of Agriculture.
F. Satoh, T. Sakuma, and H. Okajima.
Soil Science and Plant Nutrition, Vol. 36, No. 2, p 251-260, 1990. 6 fig, 2 tab, 13 ref.

Descriptors: *Aluminum, *Chelating agents, *Ion transport, *Iron, *Japan, *Organic acids, *Soil chemistry, *Soil genesis, *Soil texture, *Soil types, Acetic acid, Chemical properties, Citric acid, Migration, Oxalic acid, Soil solution, Soils, Spodosols.

Dilute solutions (0.001 M) of acetic, oxalic and citric acids were used for leaching experiments to analyze the migration process of aluminum and iron in 'fine-textured' Spodosols. Among the acids used, oxalic and citric acids showed a strong effect on the dissolution of aluminum and iron through the formation of chelate complexes. This suggests that chelation is much more important than dissolution by the soil solution at a low pH for the leaching of aluminum and iron in the soil examined. The concept of chemical equilibria was applied to analyze the mobility of aluminum and iron within the profile. Based on the stability diagram, monovalent citric and oxalic complexes with aluminum and iron were considered to be dominant. To migrate within the fine-textured soils rich in active 2:1 clay minerals, it is necessary for the aluminum and iron complexes not only to be in a low molecular weight form but also to have a low electric charge. The complexes predicted from the stability diagrams satisfied both conditions. Thus, it was concluded that the formation of chelating low molecular organic acids was significant in the migration process of aluminum and iron. (See also W91-06976) (Author's abstract)
W91-06972

STUDIES ON SALINE SOILS IN KHON KAEN REGION, NORTHEAST THAILAND: II. SEASONAL CHANGES OF PHYSICAL AND CHEMICAL PROPERTIES.
Khon Kaen Univ. (Thailand). Faculty of Agriculture.
B. Topark-Ngarm, P. Patcharapreecha, I. Goto, and M. Kimura.
Soil Science and Plant Nutrition, Vol. 36, No. 2, p 289-298, 1990. 7 fig,2 tab, 3 ref.

Descriptors: *Chemical properties, *Saline soils, *Soil chemistry, *Soil physical properties, *Soil types, *Thailand, Capillarity, Dispersion, Hydrogen ion concentration, Leaching, Physical properties, Precipitation, Seasonal variation, Subsurface water.

The dynamics of salt movement and the seasonal changes of the physical and chemical properties, especially pH and clay dispersion, of the saline soils in the Khon Kaen Region, Northeast Thailand, were investigated to obtain basic information for the improvement of saline soils. The mechanisms of seasonal changes were also studied by leaching experiments. Results indicated that not only the salt but also the clay moved upward with the capillary movement of the soil solution, and downward with the percolation of rain water. The soil pH was very low (less than 4) in the dry season and very high (nearly 9) in the rainy season, based on the following reactions: H-clay + NaCl produces Na-clay + HCl (dry season); Na-clay + H2O produces H-clay + NaOH (rainy season). The soil contained large amounts of dispersible clay in the rainy season, but a small amount in the early dry season. FeS dissolved in the groundwater was considered to be another acidification agent, as it became oxidized to ferric hydroxide and sulfuric acid when it reached the soil surface by capillary movement. (See also W91-06977) (Author's abstract)
W91-06975

TOPOSEQUENCE OF FINE-TEXTURED SOILS IN THE HILLY AREA OF NORTHERNMOST HOKKAIDO: IV. HYDROLYTIC REACTION OF ALUMINUM IN THE PRESENCE OF OXALIC OF CITRIC ACID LIGANDS.
Hokkaido Univ., Sapporo (Japan). Faculty of Agriculture.
F. Satoh, T. Sakuma, and H. Okajima.
Soil Science and Plant Nutrition, Vol. 36, No. 3, p 355-361, 1990. 6 fig, 11 ref.

Descriptors: *Aluminum, *Chelating agents, *Chelation, *Citric acid, *Hydrolysis, *Japan, *Oxalic acid, *Soil chemistry, *Soil genesis, *Soil texture, *Soil types, Chemical properties, Colloids, Organic acids, Podzols.

The hydrolysis of aluminum in aqueous solution (0.001 M) was investigated in the presence of 0.001 M of oxalic or citric acid ligands. Upon titration with base, large aluminum hydrophilic colloids (0.2-2.0 micrometer in diameter) predominated in the solution with the oxalic acid ligand, whereas micro-polymers smaller than 0.025 micrometer in diameter were stable containing the citric acid ligand. The organic ligands were not incorporated into the colloids but were adsorbed on the surface of the colloids. These findings suggest that the polymerization reaction of aluminum can take place even in the form of low molecular chelate complexes. Therefore, hypotheses were put forward concerning the mechanism of the movement of aluminum and iron in the 'fine-textured' Spodosols, in which the formation of low molecular chelate complexes was considered to be most important. The effect of low molecular chelating organic acids may account for the dissolution and accumulation process of aluminum and iron in the fine-textured soils studied. Some low molecular chelating acids, like oxalic acid, have a strong dissolution power and are also effective in the polymerization of aluminum, though not all of the processes in the formation of Spodosols were found to take place. As low molecular chelating organic acids predominate in the soil solution of Spodosols, these acids may be involved in the podzol formation process. (See also W91-06972) (Agostine-PTT)
W91-06976

STUDIES ON SALINE SOILS IN KHON KAEN REGION, NORTHEAST THAILAND: III. EFFECTS OF AMELIORATION TREATMENTS ON PHYSICAL AND CHEMICAL PROPERTIES OF THE SALINE SOIL.
Khon Kaen Univ. (Thailand). Faculty of Agriculture.
P. Patcharapreecha, B. Topark-Ngarm, I. Goto, and M. Kimura.
Soil Science and Plant Nutrition, Vol. 36, No. 3, p 363-374, 1990. 8 fig, 1 tab, 16 ref.

Descriptors: *Saline soils, *Soil amendments, *Soil physical properties, *Soil treatment, *Soil types, *Thailand, Aggregates, Calcium carbonate, Calcium sulfate, Chemical properties, Clays, Compost, Conductivity, Dispersion, Field tests, Hydrogen ion concentration, Leaching, Mulches, Oil, Statistical analysis, Straw.

The effects of several amelioration treatments on the physical and chemical properties of the saline soils (Paleustult) in the Khon Kaen Region, Northeast Thailand, were studied. The application of CaSO4, CaCO3, converter slag, or compost into the plow layer, the placement of crude oil or rice husks below the plow layer and rice straw mulching were compared. The plots with these treatments were constructed in the field and the moisture content, pH, electrical conductivity (EC), permeability, clay dispersion, NH4-N and NO3-N contents were determined. The evaluation of each amelioration treatment was as follows. Compost application was most the effective, followed by mulching. The addition of adequate, but not excessive amounts of calcium materials was necessary to increase the soil buffering capacity. The crude oil and rice husk plots showed very wide seasonal pH fluctuations as in the case of the control plot. To simulate rainfall infiltration, a leaching experiment was conducted using soils collected periodically from the above plots. The turbidity level (clay dispersion) of the leachate of CaSO4 and CaCO3 plot soils was much lower than that of the other plot soils. Compost application also had a suppressive effect on clay dispersion. Clay was dispersed easily in soils from the rice husk and crude oil plots and a high turbidity level of the leachate was observed for the rainy season samples of these plots. By mulching, dispersion was strongly suppressed, which may be due to the stability of the soil aggregates. Leaching speed was negatively correlated with the clay dispersion and it remained high throughout the experimental period (2 yr) in the CaSO4, CaCO3, converter slag and compost plots. Therefore, the combination of compost and calcium application to the soil with mulching was considered a suitable procedure for the amelioration of this kind of soil. (See also W91-06975) (Author's abstract)
W91-06977

COMPOSITION AND BEHAVIOR OF ALUMINUM IONS AND COLLOIDAL ALUMINOSILICATES IN ACIDIFIED TERRESTRIAL WATERS.
Iwate Univ., Morioka (Japan). Faculty of Agriculture.
K. Inoue, and M. Yoshida.
Soil Science and Plant Nutrition, Vol. 36, No. 3, p 461-468, 1990. 4 fig, 3 tab, 22 ref. Ministry of Education, Science and Culture of Japan Grants-in-Aid for Scientific Research 62560057, 63470106 and 01602020.

Descriptors: *Acidic water, *Aluminum, *Colloids, *Geochemistry, *Silicates, *Water chemistry, Acid rain, Acid rain effects, Chemical properties, Irrigation effects, Lakes, Rivers, Soil contamination, Water quality.

The water quality, especially in terms of the concentration and composition of Al ions of acidified terrestrial waters in the Torigoe and Iwamata Rivers and Bandai-Goshiki Lakes in the Tohoku district were investigated. The composition of aluminum in seven acidified lake and river waters in the Tohoku district was studied, and Al(+3) and hydroxy-Al (HA) ions were identified in the acidified waters. These acidified terrestrial waters contained a small but significant amount of hydroxyaluminosilicate (HAS) ions. Colloidal aluminosilicates (>0.2 micrometer) identified in the waters were characterized by the predominance of protoimogolite allophane and/or allophane. The white precipitates and gelatinous materials formed in the acidified terrestrial waters were composed of precipitated allophane. The acidic substances of the terrestrial waters were mainly composed of Al(+3), HA, and HAS ions. HAS ions and HAS colloids were first identified in the lake and river

waters. The presence of HAS ions and HAS colloids provides valuable information on the formation mechanism of precipitated allophane in the acidified terrestrial waters. The reaction giving a peculiar bluish-white color in some lakes could arise from HAS colloids suspended in the waters. There was an equilibrium relationship among HA and HAS ions, HAS colloids, and HAS sediments (allophanic) formed in the acidified terrestrial waters. The chloritization of paddy soils caused by acidified irrigation waters and the unfavorable effect on fish breeding were predominantly due to Al(+3) and HA ions in the acidified terrestrial waters. (Author's abstract)
W91-06979

EFFECT OF MOISTURE ON CHLORIMURON DEGRADATION IN SOIL.
Du Pont de Nemours (E.I.) and Co., Wilmington, DE. Agricultural Products Dept.
For primary bibliographic entry see Field 5B.
W91-06988

OCTANOL/WATER PARTITION COEFFICIENT OF METHYLMERCURIC CHLORIDE AND METHYLMERCURIC HYDROXIDE IN PURE WATER AND SALT SOLUTIONS.
Army Biomedical Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5B.
W91-06991

PERSISTENCE OF A CHEMICAL GRADIENT IN THE LOWER PLATTE RIVER, NEBRASKA.
Nebraska Univ.-Lincoln. Dept. of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 6G.
W91-07010

APPLICATION OF AUGER ELECTRON SPECTROSCOPY TO STUDIES OF CHEMICAL WEATHERING.
Montana State Univ., Bozeman. Dept. of Earth Sciences.
D. W. Mogk.
Reviews of Geophysics RVGPB4, Vol. 28, No. 4, p 337-356, November 1990. 6 fig, 1 tab, 145 ref. NSF Grant EAR 88-16648.

Descriptors: *Analytical methods, *Chemical analysis, *Emission spectroscopy, *Geochemistry, *Weathering, Chemical properties, Chemical reactions, Laboratory methods, Minerals, Molecular structure, Sample preparation, Spectroscopy.

Auger electron spectroscopy (AES) is a surface-sensitive analytical technique that derives from the interaction of an electron beam and atoms in residence at the surface of a sample; inner shell ionizations produce Auger electrons, which have an escape depth of only a few tens of angstroms. This technique has numerous applications to chemical weathering and other geochemical processes that operate on mineral surfaces. The analytical capabilities of AES include chemical analyses of the near surfaces of minerals for all elements except H and He, semiquantitative analysis of the relative atomic concentration of surface components, high lateral spatial resolution (> 0.1 microns) of the analyzed area to determine the composition of discrete domains on mineral surfaces and to identify unknown minerals on a submicrometer scale, and elemental depth profiling using an ion sputter gun. These capabilities can be used to address the nature of mineral dissolution processes, providing discrimination among mechanisms such as congruent versus incongruent dissolution, surface-controlled reactions versus diffusion through a leached or armored layer, uniform versus heterogeneous distribution of reacted layers, and identification of alteration phases. The effectiveness of AES analysis is limited by charging of nonconducting samples (e.g., silicate minerals) and sample degradation under the electron beam; these problems may be mitigated by careful sample preparation and instrument operation procedures. AES can be used in concert with numerous other microbeam techniques to fully characterize the surface compositon and structure of reacting minerals. (Author's abstract)
W91-07035

ESTIMATION OF SHALLOW GROUNDWATER QUALITY IN THE WESTERN AND SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA.
San Joaquin Valley Drainage Program, Sacramento, CA.
For primary bibliographic entry see Field 2F.
W91-07037

2L. Estuaries

SELF-PROTECTION OF ESCHERICHIA COLI IN SEAWATER.
Clyde River Purification Board, East Kilbride (Scotland).
For primary bibliographic entry see Field 5A.
W91-05972

BIOCONCENTRATION OF ENDOSULFAN IN DIFFERENT BODY TISSUES OF ESTUARINE ORGANISMS UNDER SUBLETHAL EXPOSURE.
Hiroshima Univ. (Japan). Faculty of Applied Biological Science.
For primary bibliographic entry see Field 5C.
W91-05989

PLANT SUCCESSION ON EARTHQUAKE UPLIFTED COASTAL WETLANDS, COPPER RIVER DELTA, ALASKA.
Pacific Northwest Forest and Range Experiment Station, Juneau, AK. Forestry Sciences Lab.
J. F. Thilenius.
Northwest Science NOSCAX, Vol. 64, No. 5, p 259-262, November 1990. 8 ref.

Descriptors: *Copper River Delta, *Earthquakes, *Estuaries, *Succession, *Tidal marshes, *Vegetation, Alaska, Forbs, Grasses, Levees, Sedges, Sedimentation, Shrubs, Sweet gale, Vegetation establishment, Wetlands.

In 1964, an earthquake of Richter Magnitude 8.4 to 8.6 raised the entire Copper River Delta (Alaska) 1.8-3.4 m above the previous mean sea level. The tidal regime was significantly altered: large areas of subtidal estuary became intertidal and much of the intertidal wetlands became supertidal. As a result, the rate and pattern of plant succession were also significantly altered. Supertidal wetlands with tidally deposited silt substrate presently extend 4-10 km inland from the estuary. Much of this supertidal zone was intertidal before the uplift. Gramnoids are much more common on the delta than forbs or shrubs. The most ubiquitous and abundant plant is lyngbye sedge (Carex Lyngbyaei). The low-shrub sweetgale (Myrica gale var. tomentosa) forms dense stands on levees and upper channel banks in the supertidal wetland. Initial establishment occurs first on the inside curves of the levees which parallel the channel. Eventually sedge occupies the levees on both sides of the channel. Succession from herbaceous vegetation to woody vegetation is a normal and natural progression on tidal wetlands. It already was taking place on the Copper River Delta wetlands prior to the earthquake uplift, but at a very slow rate. On a small scale, the basically geological process of levee development is enhanced by the establishment of herbaceous vegetation which, in turn, increases the rate of sediment accretion to the point where depositional rates decrease because of increased heights of the substrate surface above the level of the tide. This has, and is, taking place on the Copper River wetlands at a relatively rapid rate. It is difficult to estimate what the rates of succession would have been if the uplift had not occurred. (White-Reimer-PTT)
W91-06032

SUMMER HABITAT SUITABILITY FOR STRIPED BASS IN CHESAPEAKE BAY: REFLECTIONS ON A POPULATION DECLINE.
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. C. Coutant, and D. L. Benson.
Transactions of the American Fisheries Society TAFSAI, Vol. 119, No. 4, p 757-778, July 1990. 7 fig, 1 tab, 65 ref. EPA Contract DW 89931605-01-0, and DOE Contract DE-AC05-84OR21400.

Descriptors: *Chesapeake Bay, *Fish populations, *Striped bass, *Temperature effects, Dissolved oxygen, Fish physiology, Habitats, Maryland, Population dynamics, Reproduction, Seasonal variation, Spawning, Virginia, Water temperature.

Summer water temperatures, dissolved oxygen concentrations, distribution of striped bass Morone saxatilis subadults and adults, and juvenile abundance indices were evaluated in Chesapeake Bay to discern any influences of summer habitat suitability on historical changes in populations. Criteria for habitat suitability were those identified in freshwater reservoirs (temperature below 25 C and dissolved oxygen above 2-3 mg/L), which were confirmed for the York-Pamunkey estuary in the lower bay. Habitat suitability in the upper central basin in July declined significantly from 1962 to 1987, as did juvenile abundance indices (mean catches per standard seine haul). Thickness of suitable temperature-oxygen habitat correlated significantly with Maryland juvenile indices the following year. Relative reproductive performance of upper (Maryland) and lower (Virginia) bay stocks changed between 1967-1973 and 1980-1988 in parallel with reduction in upper bay summer habitat. The annual temperature-oxygen cycle in the bay revealed two key areas for striped bass subadults and adults: (1) a zone of cool water in north-central Chesapeake Bay near Annapolis, Maryland, where fish of these ages congregate in summer, and (2) a shallow sill across the lower bay near the mouth of the Rappahannock River, Virginia, where warm surface waters (>25 C) in summer impinge on the bottom and may block egress from the bay. The importance of year-round bay residents for reproduction in the upper bay may have been underestimated previously, at least for the recent low population levels. Reduced juvenile production at the head of the bay and population decline would be consistent with limitation of historically important habitat in summer and resultant physiological stresses of high temperature and low dissolved oxygen that affect reproductive competence the following year. (Author's abstract)
W91-06038

SEWAGE-RELATED IMPACT ON KUWAIT'S MARINE ENVIRONMENT--A CASE STUDY.
Kuwait Inst. for Scientific Research, Safat. Environmental and Earth Sciences Div.
For primary bibliographic entry see Field 5C.
W91-06058

NONLINEAR TIDAL WAVES IN A KIND OF ESTUARY WITH GRADUALLY VARYING CROSS-SECTION.
Department of Physical Oceanography and Marine Meteorology, Ocean University of Qingdao, Qingdao, China.
Y. Du, Z. Chen, and A. Ye.
Acta Oceanologica Sinica, Vol. 9, No. 1, p 37-50, 1990. 6 fig, 1 tab, 12 ref.

Descriptors: *Estuaries, *Hydrodynamics, *Mathematical analysis, *Model studies, *Tidal currents, *Tidal waves, China, Friction, Hangzhou Bay, Mathematical models, Shallow water, Water currents, Waves.

Nonlinear tidal waves were studied in an estuary that has exponentially varying width and uniform depth. One-dimensional nonlinear hydrodynamic equations were used and solved by using the perturbation method. Under the assumption of linear friction coefficient, shallow water constituent waves consist of two parts, one produced by shallow water nonlinear effects outside the estuary, and the other generated by shallow water nonlinear effects inside the estuary. Residual tidal current and elevation result from the interaction of shallow water nonlinear effects, friction, and estuarine deforming effects. The shallow water constituent waves depend chiefly on shallow water nonlinear

effects. The nonlinear model was applied to the tidal waves in the Hangzhou Bay, China. Seven of the constituent waves were taken into account. Because the results modeled by incident progressive waves and their interaction agree well with observations, it can be concluded that incident progressive waves are dominant in the Hangzhou Bay. (Author's abstract)
W91-06099

PRELIMINARY STUDY ON THE DISTRIBUTION OF NUTRIENTS, ORGANIC MATTER, TRACE METALS IN SEA SURFACE MICROLAYER IN XIAMEN BAY AND JIULONG ESTUARY.
Xiamen Univ. (China). Dept. of Oceanography.
H. Hong, and J. Lin.
Acta Oceanologica Sinica, Vol. 9, No. 1, p 81-90, 1990. 1 fig, 7 tab, 14 ref.

Descriptors: *Enrichment, *Estuarine environment, *Nutrients, *Organic matter, *Trace metals, Cadmium, China, Copper, Dissolved organic carbon, Jiulong Estuary, Nickel, Nitrates, Nitrites, Nitrogen, Organic carbon, Particulate matter, Phosphates, Sampling, Suspended solids, Xiamen Bay.

The enrichment of nutrients, suspended particles, organic matter, and trace metals was determined in the sea surface microlayer of Xiamen Bay and Jiulong Estuary (China). Nutrients studied include nitrates, nitrites, and phosphates; organic matter includes particulate organic carbon, particulate organic nitrogen, and dissolved organic carbon; trace metals include copper, nickel, and cadmium. The mean enrichment factors mostly ranged between 1.0 and 2.0. The dissolved forms were the major forms of the components measured. The enrichment of dissolved organic matter and suspended particles could lead to changes in the total amount and speciation of nutrients and trace metals. No correlation was observed between sample concentrations, speciation, enrichment factors, and sample locations. However, some evidence shows that these parameters are correlated with sea state, indicating the complexity and dynamic nature of the sea surface microlayer. (Doria-PTT)
W91-06100

STUDY OF MIXING RATES AND SEDIMENTATION RATES IN MEIZHOU BAY SEDIMENTS.
Academia Sinica, Guangzhou (China). South China Sea Inst. of Oceanology.
S. Chen, W. Li, W. Shi, and Y. Huang.
Acta Oceanologica Sinica, Vol. 9, No. 1, p 109-117, 1990. 6 fig, 2 tab, 9 ref.

Descriptors: *Coastal environment, *Mixing, *Radioactive tracers, *Sedimentation, Bays, Bismuth, Cesium radioisotopes, China, Harbors, Heavy metals, Lead radioisotopes, Meizhou Bay, Polonium radioisotopes, Sedimentation rates, Thorium radioisotopes, Tracers.

The double-layer model of Pb210 chronology in coastal areas was used in the study of sedimentation and mixing in Meizhou Bay (China). The sedimentation rate is 0.53 cm/yr and the mixing coefficient is 0.1 millionths sq cm/sec at Station Xiuyu; the sedimentation rate is 1.50 cm/yr at Station Fengwei. The sedimentation rate deduced from Pb dating with the Pb210/Po210 method is 0.69 at Station Xiuyu, greater than that with the Pb210/Bi210 method. Sedimentation rates at Stations Xiuyu and Fengwei are 0.39 and 1.18 cm/yr respectively using the artificial radionuclide Cs137. The depth distribution of excess Th234 indicated that mixing occurred in the sediment surface layer, the mixing coefficient is 0.49 millionths sq cm/sec, greater than the result obtained from excess Pb210 distribution. (Doria-PTT)
W91-06101

EFFECTS OF A MIXTURE OF CU, CD, HG AND ZN ON MARINE PLANKTON: MARINE ECOSYSTEM ENCLOSURE EXPERIMENT.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
For primary bibliographic entry see Field 5C.
W91-06102

EFFECTS OF SEDIMENT FROM AN INDUSTRIAL OUTFALL AREA ON A MARINE PLANKTONIC ECOSYSTEM.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
For primary bibliographic entry see Field 5C.
W91-06103

PATHWAY AND FATE OF THE HEAVY METAL MIXTURE IN XIAMEN MARINE EXPERIMENT ENCLOSURES.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
For primary bibliographic entry see Field 5B.
W91-06104

PHOSPHATE LIMITATION OF PHYTOPLANKTON GROWTH IN THE CHANGJIANG ESTUARY.
Xiamen Univ. (China). Dept. of Oceanography.
For primary bibliographic entry see Field 5C.
W91-06105

ECOLOGICAL STUDIES ON THE HYDROMEDUSAE, SIPHONOPHORES AND CTENOPHORES IN THE XIAMEN HARBOR AND ADJACENT WATERS.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
M. Lin, and J. Zhang.
Acta Oceanologica Sinica, Vol. 9, No. 3, p 429-438, 1990. 5 fig, 1 tab, 25 ref.

Descriptors: *Ecological distribution, *Invertebrates, *Marine environment, Chemical properties, China, Ecology, Harbors, Physical properties, Salinity, Sampling, Seasonal variation, Species composition, Water temperature, Xiamen Harbor.

The species composition, seasonal change, and horizontal distribution of the Hydromedusae, Siphonophores, and Ctenophores in the Xiamen Harbor (China) and their relationship to environmental factors were studied. Samples from 17 stations in the Xiamen Harbor and adjacent waters were taken once monthly between September 1980 and August 1981. Results indicate that for the dominant species of Phialidium folleatum, Lensia subtiloides, and Pleurobrachia globosa, the total annual number of species has one peak and the total annual number of individuals has one peak and two secondary peaks. On the basis of their ecological characteristics, the Hydromedusae, Siphonophores, and Ctenophores found in the this region may be divided into an estuarine group, a neritic group, and an oceanic group. Their seasonal succession is correlated with the relative intensity of several water systems. (Author's abstract)
W91-06106

FINITE ELEMENT MODEL OF CIRCULATION IN SHALLOW WATER WITH MOVING BOUNDARY ON TIDAL-FLAT.
Institute of Marine Environmental Protection, Dalian (China).
Z. Cunzhi, Y. Lianwu, and D. Zhenxing.
Acta Oceanologica Sinica, Vol. 9, No. 2, p 173-186, 1990. 13 fig, 1 tab, 5 ref.

Descriptors: *China, *Computer models, *Model studies, *Shoals, *Tidal flats, *Water boundary, *Water circulation, Bottom currents, Boundaries, Coriolis force, Galerkin method, Geohydrologic boundaries, Mathematical boundaries.

Numerical models of hydrodynamics have been widely applied in coastal waters and have become an effective technique for environmental assessments and predictions. It has not been sufficient, however, to describe correctly the land-water boundary that would have tremendous influence upon the computed result in shoaling waters with large tidal flat. The circulation in shallow water with tidal flat was examined with a finite element model for the numerical solution of the shallow water equations by means of the standard Galerkin's method. The domain computed was covered with triangular finite elements, and water elevation and velocity were approximated by linear interpolation functions, and the lumped coefficients were used to substitute for solving the high order algebraic equation system. The time-dependent land-water boundary changes were treated mathematically by interrelating the location of the land-water boundary with the instantaneous tidal level. The implicit scheme was adopted for the terms of the bottom friction and the Coriolis effect in the motion equation so that the numerical stability of the model was improved. The model was applied to the tidal current on shoaling water with large tidal flat off Pikou Port, China. A comparison between observed and calculated values showed good agreement, with the flow pattern adequately reproduced. The result showed that the model could be widely applied for predicting the circulation in shoaling waters. (Mertz-PTT)
W91-06218

POPULATION DYNAMICS AND SECONDARY PRODUCTION OF OWENIA FUSIFORMIS DELLE CHIAJE (POLYCHAETA) FROM THE BAY OF SEINE (EASTERN ENGLISH CHANNEL).
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
For primary bibliographic entry see Field 2H.
W91-06246

MANAGEMENT OF COASTAL ZONE EROSION IN NIGERIA.
Port Harcourt Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06267

COLUMBIA RIVER ESTUARY STUDIES: AN INTRODUCTION TO THE ESTUARY, A BRIEF HISTORY, AND PRIOR STUDIES.
Washington Univ., Seattle. Fisheries Research Inst.
C. A. Simenstad, L. F. Small, C. D. McIntire, D. A. Jay, and C. Sherwood.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 1-13, 1990. 3 fig, 1 tab, 74 ref.

Descriptors: *Columbia River, *Data collections, *Ecology, *Estuaries, *Rivers, *Sedimentology, Data acquisition, Data interpretation, Hydrology, Regional analysis, Seasonal distribution.

The Columbia River is the second largest river in the United States, with a drainage basin, covering a total of 660,480 sq km in seven states and two Canadian provinces. The mean annual discharge is about 5500 cu m/s, exclusive of irrigation depletion of about 400 cu m/s, and the regulated peak discharge is 12,000 cu m/s. The river supplies about 9.7 million metric tons of sediment per year to the estuary. The Columbia River Estuary Data Development Program (CREDDP) was established to increase understanding of the hydrology, sedimentology, and ecology of the estuary. A review of the numerous, diverse studies of certain physical and biological characteristics of the Columbia River Estuary conducted prior to the formation of the CREDDP was presented. The CREDDP study region included about 75 km of the river-estuarine continuum, stretching from the mouth to about 20 km above the maximum extent of salinity intrusion. To facilitate seasonal comparisons, the present annual flow cycle was partitioned among three 'hydrological' seasons: (1) winter or fluctuating flow (November-March); (2) spring or high flow (April-June); and (3) summer-fall, or low flow (July-October). Primarily on the basis of circulation and sedimentological features, the estuary was stratified spatially into three estuarine zones: Plume and Ocean, Estuarine Mixing, and Tidal Fluvial; these were further divided into ten regions. Superimposed on the regional divisions are some or all of the following six habitat types: (1) water column; (2) high marsh and swamp; (3) low marsh; (4) tidal flats; (5) demersal slopes; and (6)

channel bottom. (See W91-06280 thru W91-06288) (MacKeen-PTT)
W91-06279

SEDIMENTARY GEOLOGY OF THE COLUMBIA RIVER ESTUARY.
Battelle/Marine Sciences Lab., Sequim, WA.
C. R. Sherwood, and J. S. Creager.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 15-79, 1990. 37 fig, 5 tab, 100 ref.

Descriptors: *Estuaries, *Estuarine sediments, *River beds, *Sedimentology, Bed load, Bottom sediments, Columbia River, Geology, Particle size, Seasonal variation, Sediment analysis, Sediment sorting, Sediment transport.

A multi-year study of the sedimentary geology of the Columbia River Estuary was performed. Analyses of more than 2000 bottom-sediment grab samples indicated that the bed material of the estuary varies in a relatively narrow range between 0 and 8 phi with an overall mean size of 2.5 phi. Sediment size decreases generally in the downstream direction. Sediments from the up-river channels are coarse (1.5-2.0 phi) and moderately well sorted; sediments in the central estuary show a wider range and variation in grain size and sorting (1.75-6.0 phi). Sediment from the entrance region has a mean size of 2.75 phi and is well sorted. Seasonal changes in sediment size distributions occur and are best delineated by those samples containing more than 10% mud (silt plus clay). The distribution of bedforms of various size and shape has been mapped with side-scan sonar during three seasons and at various tidal stages. The presence of bedforms with wavelengths of 6-8 m and alternating slip faces about 40 cm high indicates that the deeper portion of the entrance region is dominated by tidally reversing lower flow regime sediment transport. Larger bedforms in the upper reaches of the estuary (maximum height, 3 m; maximum wavelength, 100 m) with smaller, superimposed bedforms, imply downstream bedform transport under fluvial conditions. The landward limit of up-river bedform transport varies seasonally in response to river flow fluctuations. The complex sedimentary environments in the Columbia River estuary are influenced by the relative importance of waves, fluvial currents, and tidal currents, as modified by estuarine circulation, vegetation, or human activity. (See also W91-06279 and W91-06281 thru W91-06288) (Author's abstract)
W91-06280

CIRCULATION, DENSITY DISTRIBUTION AND NEAP-SPRING TRANSITIONS IN THE COLUMBIA RIVER ESTUARY.
Washington Univ., Seattle. Geophysics Program.
D. A. Jay, and J. D. Smith.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 81-112, 1990. 21 fig, 1 tab, 30 ref. NSF Grant OCE 8208856.

Descriptors: *Columbia River, *Estuaries, *Rivers, *Tides, *Water circulation, Flow rates, Neap tides, River flow, Saline water intrusion, Salinity currents, Solute transport, Spring tides, Stratification, Tidal rivers, Topography.

The circulation of the Columbia River estuary was studied using tidal-monthly variations in the density and velocity fields and salt and water transports. With regard to the velocity field, the influence of stratification causes the tidal flow to show the largest vertical variations in phase and amplitude in the lower estuary. The vertical distribution of the mean current is controlled by the ebb-flood asymmetry in the time-dependent flow, vertical mixing processes, the baroclinic pressure gradient, and interaction of the flow with topography. Net upstream bottom flow is weak or absent during periods of weak stratification; it is substantial only when the system is highly stratified. Net upstream bottom flow tends to occur downstream of, and net downstream flow upstream of, topographic highs. This pattern of convergence in the mean flow tends to preserve these topographic highs and lows and is not consistent with the traditional view that the baroclinic mean flow and mean salinity distribution structure one another. Comprehensive salt transport calculations indicated that neap-spring and seasonal variability of the gross features of the salinity intrusion in the lower estuary are limited by compensating adjustments of the tidal advective and mean-flow salt transports under most river flow conditions. In contrast, the absence of such balancing mechanisms in combination with substantial neap-spring changes in vertical mixing allow large variations in the density field and salinity intrusion length in the upper estuary. Neap-spring variability is much higher during the low-flow season than during the high-flow season. The salt transport calculations also showed that salt is carried into the estuary near mid-depth by tidal mechanisms acting primarily in the North Channel. Salt is transported out of the estuary closer to the surface of the South Channel by the strong mean flow. It is likely that inward tidal transport of salt occurs at mid-depth in many estuaries, as this is where salinity variations during the tidal cycle are usually the greatest. (See W91-06279, W91-06280, and W91-06282 thru W91-06288)
W91-06281

MODELLING SALINITY AND CIRCULATION FOR THE COLUMBIA RIVER ESTUARY.
Science Applications International Corp., Raleigh, NC.
P. Hamilton.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 113-156, 1990. 15 fig, 1 tab, 38 ref. U.S. Army Engineer Portland District Contract DACW57-83-M-1730.

Descriptors: *Columbia River, *Estuaries, *Mathematical models, *Model studies, *Rivers, *Saline water intrusion, *Tides, Flow rates, Neap tides, River flow, Salinity currents, Simulation analysis, Spring tides, Tidal rivers, Water currents.

Simulations of the time and depth-dependent salinity and current fields of the Columbia River Estuary have been performed using a multi-channel, laterally averaged estuary model. The study simulated two periods. The first, in October 1980, with low river flow of about 4,000 cu m/s, showed marked changes in the salinity intrusion processes between neap and spring tides. The second period, in spring 1981, with high river flow varying between 7,000 and 15,000 cu m/s, showed the rapid response of the salinity intrusion to changes in river flow and that vertical mixing did not change character with increasing tidal energy because of the maintenance of stratification by freshwater flow. An extreme low flow simulation (river flow of 2,000 cu m/s) showed a more partially mixed character of the estuary channels with tidal dispersion of salt across the Taylor Sands from the North Channel to the upper reaches of the Navigation Channel. Asymmetries in the non-linear tidal mean flows, in the flood and ebb circulations, and salinity intrusion characteristics between the two major channels were observed at all river flows. The model confirmed that tidal advection of salt by the vertically sheared tidal currents is the dominant mechanism by which the salinity intrusion is maintained against large freshwater flows. An accurate finite-difference method, which minimized numerical dispersion, was used for the advection terms and was an important component in reasonably simulating the October neap-spring differences in salinity intrusion. The simulations compare favorably with elevation, current and salinity time series observations taken during October 1980 and spring 1981. (See W91-06279 thru W91-06281 and W91-06283 thru W91-06288) (Author's abstract)
W91-06282

ENERGETICS AND SEDIMENTARY PROCESSES IN THE COLUMBIA RIVER ESTUARY.
Washington Univ., Seattle. Geophysics Program.
D. A. Jay, B. S. Giese, and C. R. Sherwood.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 157-174, 1990. 3 fig, 1 tab, 21 ref. NSF Grant OCE 8208856.

Descriptors: *Columbia River, *Estuaries, *Estuarine sediments, *Model studies, *Sediment distribution, *Sedimentology, *Tidal rivers, Energetics, Energy budget, Particle size, River beds, Sediment transport, Tides.

The relationship between energetics and sedimentary processes in the Columbia River Estuary was investigated. An energy budget based on a one-dimensional harmonic tidal model was developed for the estuary-tidal river system and has been compared with the results of geological studies of the bedforms, large-scale morphology, sediment distribution, and suspended sediment field. The pattern of energy fluxes predicted by the model suggests the division of the system into three regions: a tidally dominated lower estuary, a mid-estuary energy flux divergence (EFD) minimum region, and a fluvially controlled, tidal-fluvial reach. Model results also show that non-linear interactions between the tidal and fluvial flows are responsible for the suppression of the tides in the tidal-fluvial reach during periods of high flow. Finally, changes in tidal amplitude at the mouth result in a less than proportionate response in tidal elevations at points inside the estuary, because the cubic dependence of dissipation on tidal amplitude damps system responses to such changes. Many features of the observed sediment transport patterns and sedimentary environments can be related to the energy budget. Most of the medium to coarse sands entering the system from the river are permanently retained within the EFD minimum. Much of this deposition takes place upstream of the limits of salinity intrusion and is not, therefore related to baroclinic circulatory effects. Most of the fine silts and clays entering the system are not permanently retained. Some are temporarily retained in a turbidity maximum, whose mean position is near the lower end of the EFD minimum. This position is dictated by the inability of salinity intrusion to extend up the fluvial potential energy gradient. It is concluded that the model provides a valuable conceptual approach to the dominant long-term sedimentary processes of sand transport and deposition in the Columbia River Estuary that structure the observed sedimentary environments. (See W91-06279 thru W91-06282 and W91-06284 thru W91-06288) (Author's abstract)
W91-06283

PRIMARY PRODUCTION, PLANT AND DETRITAL BIOMASS, AND PARTICLE TRANSPORT IN THE COLUMBIA RIVER ESTUARY.
Oregon State Univ., Corvallis. Coll. of Oceanography.
L. F. Small, C. D. McIntire, K. B. MacDonald, J. R. Lara-Lara, and B. E. Frey.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 175-210, 1990. 11 fig, 13 tab, 49 ref.

Descriptors: *Aquatic plants, *Columbia River Estuary, *Detritus, *Estuaries, *Organic matter, *Primary productivity, *Rivers, Algae, Biomass, Decomposing organic matter, Particle transport, Particulate matter, Phytoplankton, Salinity, Tidal rivers.

The dynamics of primary production and particulate detritus cycling in the Columbia River Estuary were studied. Analysis of phytoplankton flora and biomass and in distribution of detrital particulate organic matter (DPOC) in the water column indicated that salinities of 1-5 delineated an essentially freshwater flora from a marine or euryhaline flora, and that living phytoplankton was converted to DPOC at the freshwater-brackish water interface. Similarly, the benthic diatom assemblages on tidal flats reflected either the fresh or the brackish nature of the water inundating the flats. Emergent vascular plants were grouped into associations separated mainly on the bases of different relative abundances of freshwater, euryhaline or brackish water species, and on whether samples occurred in high or low marsh areas. Annual rates of net areal 24-hr production averaged 55, 16, and 403 g C/sq m/y for phytoplankton, benthic algae, and emergent vascular vegetation, respectively. Total production over the whole estuary was 17,667, 1,545, and 11,325 mt C/y for phytoplankton, benthic algae, and emergent vascular plants, respectively. Phytoplankton biomass turned over approximately 39 times per year on average, while benthic algae turned over about twice and emergent plants once per year. Budgets for phytoplankton carbon (PPOC) and DPOC were developed based on PPOC and DPOC import and export, grazing loss,

and in situ production and conversion of PPOC to DPOC. Perhaps 36,205 mt/y of PPOC is converted to DPOC in the estuary, principally at the freshwater-brackish water interface. About 40,560 mt/y of PPOC is exported to the ocean, and 159,185 mt/y of DPOC is transported into the marine zone of the estuary. Thus, the estuary acts principally as a conduit for the transport of particles to the sea, and only secondarily as a converter of viable phytoplankton cells to detrital carbon and as a trap for DPOC. (See W91-06279 thru W91-06283 and W91-06285 thru W91-06288) (Author's abstract)
W91-06284

COMMUNITY STRUCTURE, DISTRIBUTION, AND STANDING STOCK OF BENTHOS, EPIBENTHOS, AND PLANKTON IN THE COLUMBIA RIVER ESTUARY.
Oregon Dept. of Fish and Wildlife, Corvallis.
K. K. Jones, C. A. Simenstad, D. L. Higley, and D. L. Bottom.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 211-241, 1990. 10 fig, 2 tab, 39 ref.

Descriptors: *Aquatic animals, *Aquatic habitats, *Benthos, *Columbia River Estuary, *Estuaries, *Rivers, *Secondary productivity, Biomass, River flow, Salinity, Tidal flats, Tidal rivers.

Secondary producers were sampled in the Columbia River estuary during the 1980-81 Columbia River Data Development Program (CREDDP) studies. Benthic infaunal macroinvertebrates were sampled in all estuarine zones and habitats with a grab sampler during a single estuary-wide survey. Epibenthic macrofauna and meiofauna were sampled monthly with epibenthic pump and sled, beach seine, and trawl in tidal flat, slope, and channel bottom habitats throughout the estuary. Zooplankton and larval fish were sampled monthly with oblique zooplankton net tows in the main channel. The distribution of secondary consumers coincided with division of the estuary into three salinity zones and six habitat types, where principal physical and biological processes that influenced the distribution and assemblage structure of secondary consumers were: (1) river discharge; (2) river discharge and tidal flow interaction which created circulation and salinity patterns and turbidity maximum characteristics; and (3) benthic processes, such as sediment type and transport and geomorphology. Standing stocks of benthic infauna were highest in protected tidal flat habitats and were comparatively depressed in the estuarine mixing zone of the estuary. Standing stocks of epibenthic and zooplanktonic organisms, in contrast, were concentrated within the estuarine mixing zone. (See W91-06279 thru W91-06284 and W91-06286 thru W91-06288) (Author's abstract)
W91-06285

SPECIES COMPOSITION, DISTRIBUTION, AND INVERTEBRATE PREY OF FISH ASSEMBLAGES IN THE COLUMBIA RIVER ESTUARY.
Oregon Dept. of Fish and Wildlife, Corvallis.
D. L. Bottom, and K. K. Jones.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 243-270, 1990. 12 fig, 3 tab, 77 ref.

Descriptors: *Columbia River Estuary, *Estuaries, *Fish, *Fish populations, *Rivers, Population density, Predation, Seasonal variation, Species composition, Species diversity, Turbidity.

The fish community of the Columbia River Estuary was sampled with trawl, beach seine, and purse seine over an 18-month period during 1980-81. Seasonality of abundance and species richness in the estuary reflect the timing of migrations and the reproductive cycles of marine and anadromous species. Composition of the fish community and dominant species in the Columbia River Estuary are similar to manu smaller estuaries in the Pacific Northwest. These similarities reflect the influence of the nearshore marine environment on fish community structure throughout the West Coast as well as the wide geographic distribution and considerable physiological tolerance of many dominant euryhaline species. The distribution of fish assemblages within the Columbia River Estuary is influenced by large seasonal variation in river discharge and salinity. Within large areas or salinity zones, species assemblages use different habitats and invertebrate prey. The distribution of abundance and the stomach fullness of fishes vary directly with the density of potential prey. It is hypothesized that fish production may be limited by dynamic physical processes that control prey availability or the feeding efficiencies of predators in the highly turbid estuary. (See W91-06279 thru W91-06285, W91-06287, and W91-06288) (Author's abstract)
W91-06286

CONSUMPTION PROCESSES AND FOOD WEB STRUCTURE IN THE COLUMBIA RIVER ESTUARY.
Washington Univ., Seattle. Fisheries Research Inst.
C. A. Simenstad, L. F. Small, and C. D. McIntire.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 271-297, 1990. 1 fig, 7 tab, 65 ref.

Descriptors: *Aquatic life, *Columbia River Estuary, *Estuaries, *Food chains, *Rivers, Aquatic productivity, Consumption processes, Detritus, Erosion, Estuarine environment, Predation, Salinity, Sedimentation.

Consumption processes at several trophic levels tend to converge in the central (estuarine-mixing) region of the Columbia River estuary, where living and detrital food resources are entrained within the energy null of the turbidity maximum zone. Primary consumers in this region are generalist and omnivorous feeders, capable of exploiting both heterotrophic and autotrophic food web pathways. In the presence of higher standing stocks of their prey resources, feeding by secondary and tertiary consumers is also concentrated, or more effective, in the estuarine mixing region of the estuary. During the 1980-81 studies of the estuary, total consumer (metazoan) production averaged 5.5 g C/sq m within the estuary. Of the estimated 15,000 mt C/y attributed to primary consumption in the water column, 83% was the result of suspension-feeding pelagic zooplankton. In comparison to grazing on phytoplankton, it was estimated that approximately 84% of primary consumption in the water column was based on suspended detritus and, presumably, associated microbiota. Endemic primary consumers, principally epibenthic crustaceans accounted for a high proportion of the consumption of suspended particles. Wetland herbivores inhabiting the estuary's extensive marshes, on the other hand, were estimated to account for only 2 to 17% of total estuarine primary consumption. Trophic linkages to secondary and tertiary consumers were more evenly apportioned among pelagic fishes, motile macroinvertebrates, and benthic infauna. High, comparatively unknown fluxes of migratory or wide-ranging tertiary consumers, such as piscivorous birds, seals and sea lions, made estimation of their annual consumption rates in the estuary highly tenuous. The physical processes of mixing and stratification, sediment accretion and erosion, and salinity intrusion appear to be the fundamental determinants of consumption processes in the Columbia River estuary. (See W91-06279 thru W91-06286 and W91-06288) (Author's abstract)
W91-06287

HISTORICAL CHANGES IN THE COLUMBIA RIVER ESTUARY.
Washington Univ., Seattle. School of Oceanography.
C. R. Sherwood, D. A. Jay, R. B. Harvey, P. Hamilton, and C. A. Simenstad.
Progress in Oceanography POCNA8, Vol. 25, No. 1/4, p 299-352, 1990. 22 fig, 7 tab, 76 ref. NSF Grant OCE-8504237.

Descriptors: *Columbia River, *Data interpretation, *Estuaries, *Hydrology, *Irrigation effects, *Navigation, *Oceanography, *Rivers, *Sedimentology, Cartography, History, Model studies, River flow, Statistical analysis, Tidal rivers.

Historical changes in the hydrology, sedimentology, and physical oceanography of the Columbia Estuary have been evaluated with a combination of statistical, cartographic, and numerical modelling techniques. Comparison of data digitized from the US Coast and Geodetic Survey bathymetric surveys conducted in the periods 1867-75, 1926-37, and 1949-58 reveals that large changes in the morphology of the estuary have been caused by navigational improvements and by the diking and filling of much of the wetland area. The data also indicate that, ignoring erosion at the entrance of the estuary, 370 to 485 million cubic meters of sediment has been deposited in the estuary since 1868 at an average rate of 0.5 cm/y, roughly 5 times the rate at which sea level has fallen locally since the turn of the century. River flow data indicate that the seasonal flow cycle of the Columbia River has been significantly altered by regulation and diversion of water for irrigation. The greatest changes have occurred in the last thirty years. Flow variability over periods greater than a month has been significantly damped and the net discharge has been slightly reduced. Results from a laterally averaged, multiple-channel, two-dimensional numerical flow model suggest that the changes in morphology and river flow have reduced mixing, increased stratification, altered the response to fortnightly (neap-spring) changes in tidal forcing, and decreased the salinity intrusion length and the transport of salt into the estuary. The overall effects of human intervention in the physical processes of the Columbia River Estuary (i.e. decrease in freshwater inflow, tidal prism, and mixing; increase in flushing time and fine sediment deposition, and net accumulation of sediment) are qualitatively similar to those observed in less energetic and more obviously altered estuarine systems. (See W91-06279 thru W91-06287) (Author's abstract)
W91-06288

LITTER PRODUCTION BY MANGROVES: III. WAVECREST (TRANSKEI) WITH PREDICTIONS FOR OTHER TRANSKEI ESTUARIES.
Durban-Westville Univ. (South Africa). Dept. of Botany.
T. D. Steinke, and C. J. Ward.
South African Journal of Botany SAJBDD, Vol. 56, No. 5, p 514-519, October 1990. 5 fig, 3 tab, 28 ref.

Descriptors: *Detritus, *Estuaries, *Litter, *Mangrove swamps, *Trees, Leaves, Seasonal variation, South Africa, Transkei Estuary, Wave crest.

Litter fall was measured in a mixed mangrove community in Wavecrest, South Africa in which Avicennia marina (Forssk.) Vierh. was dominant over Bruguiera gymnorrhiza (L.) Lam. Mean litter production was 1.24 g dry matter/sq m/d or 4.51 tons/ha/y over a 3-year period. Mean annual leaf yield comprised approximately 72% of total litter. Generally greater leaf fall occurred in the summer than in the winter. In both A. marina and B. gymnorrhiza, propagule production was variable from year to year. In both species, reproductive material was present on the trees almost throughout the year. This behavior and the low litter yields appeared to indicate that the community is approaching its southern limits. From the 14 ha of mangroves in the estuary, it is calculated that the total litter production is 50.7 tons/y, of which approximately 36.8 tons/y is leaf litter. The total litter production of the larger stands of mangroves in Transkei's estuaries was calculated. Mangrove litter is considered to provide a significant input to these systems. (Author's abstract)
W91-06289

MECHANISMS OF THE BLACK SEA CIRCULATION.
Sofia Univ. (Bulgaria). Dept. of Geophysics.
For primary bibliographic entry see Field 2B.
W91-06410

ENERGY WASTE STABILIZATION TECHNOLOGY FOR USE IN ARTIFICIAL REEF CONSTRUCTION.
Florida Inst. of Tech., Melbourne. Dept. of Chemical and Environmental Engineering.

For primary bibliographic entry see Field 5E.
W91-06674

CHEMICAL HYDROLOGY AND MACROPHYTE VEGETATION IN THE CANALS OF A MEDITERRANEAN COASTAL MARSH.
Universitat de les Illes Balears, Palma de Mallorca (Spain). Dept. de Biologia y Ciencias de Salud.
A. Martinez Taberner, G. Moya, G. Ramon, and V. Forteza.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 67-87, November 1990. 13 fig, 1 tab, 26 ref.

Descriptors: *Aquatic plants, *Canals, *Marshes, *Water chemistry, *Wetlands, Albufera Marsh, Alkalinity, Coastal marshes, Macrophytes, Majorca, Salinity, Seasonal variation, Water temperature.

A canal system linking waters directly to the sea was built in the Albufera of Majorca during the last century in order to drain the area. The area was sampled seasonally from summer 1983 to summer 1985 at 35 to 40 sites. Conductivity and chloride concentrations were as expected in that climate with dilution periods observed in autumn and winter. In summer wedge-shaped marine water incursions occurred that were more apparent in the deeper water areas. Temperature was observed to fluctuate annually in both long and short canals. In general, pH increased during the productive periods in summer and spring and decreased during the winter. It is concluded that a strong physico-chemical gradient develops along the canals, with fresh waters enriched with N upstream near the farming area, and saline, phosphate-rich waters developing near the sea and coastal urban development. The physico-chemical changes in the heterogeneity of the gradient from the upper Albufera to the sea offers a diversity of habitats colonized by different macrophytes. Consequently there is a variety of food resources and habitats for other species such as crustaceans, fish, and birds. (MacKeen-PTT)
W91-06755

PRODUCTION AND POPULATION DYNAMICS OF PACHYMELANIA AURITA MULLER.
Ibadan Univ. (Nigeria). Dept. of Zoology.
E. A. Ajao, and O. Fagade.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 97-109, November 1990. 9 fig, 6 tab, 15 ref.

Descriptors: *Aquatic animals, *Aquatic productivity, *Gastropods, *Lagoons, *Nigeria, *Water pollution effects, Brackish water, Clays, Lagos Lagoon, Metals, Mollusks, Population dynamics, Silt.

From February 1985 to December 1986, a study was made on the production and population dynamics of Pachymelania aurita Muller occurring in Lagos lagoon. Its abundance was related to silt-clay, total organic matter and the metal contents at three sites in the lagoon. Greatest densities of P. aurita occurred at the site furthest from anthropogenic inputs of sewage and industrial effluents and in sediments containing 6 to 40% silt-clay. The breeding season coincided with the end of the rainy season and beginning of the dry season (November to May). Spawning was observed from mid-December to early April. Annual production varied between 0.0475 and 6.479 g/cu cm/yr (formalin fixed ash-free dry weight) and amounted to 89.8-100% of the total molluscan production at the sampling stations. The production:biomass (P:B) ratio varied between 0.007 and 2.27. It was concluded that organic matter and toxic heavy metal pollution in the industrialized portion of the lagoon limited the production and abundance of P. aurita. (Author's abstract)
W91-06757

FORMATION OF THE INTERMEDIATE WATER MASSES OFF THE EGYPTIAN MEDITERRANEAN COAST.
Institute of Oceanography and Fisheries, Alexandria (Egypt).
M. A. Said, and A. M. Karam.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 111-122, November 1990. 15 fig, 11 ref.

Descriptors: *Coastal waters, *Egypt, *Mediterranean Sea, *Salinity, *Water masses, Salinity currents, Seawater, Water currents, Water temperature.

The formation of intermediate water masses characterized by a secondary maximum of salinity was studied along the Egyptian Mediterranean coast. Results of previous studies suggesting two areas of formation of intermediate water were confirmed: the area to the east of longitude 29 degrees and west of Alexandria; and the area in front of Damietta. In addition, a new source was identified which appeared to be a region of a salinity extreme (>39.30 ppt). This area is also characterized by a relatively high temperature (>17 C). The isopynic analysis of the area indicted that the saline warm water flows away from the continental shelf to the northwest in a high-salinity tongue and reaches the open sea with values as low as 38.95 ppt. This supports the suggestion that more than one starting point representing various sources of formation of the intermediate water mass of maximum salinity are present in the Levantine basin. (Author's abstract)
W91-06758

SEASONAL RESPONSE OF THE LOWER ST LAWRENCE ESTUARY TO BUOYANCY FORCING BY REGULATED RIVER RUNOFF.
Institut National de la Recherche Scientifique, Rimouski (Quebec). Centre d'Oceanologia.
V. G. Koutitonsky, R. E. Wilson, and M. I. El-Sabh.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 359-379, October 1990. 14 fig, 1 tab, 46 ref. NSERC Grants A1426, A0073, and RD0424. NSF Grant OCE8701061.

Descriptors: *Estuaries, *Model studies, *Regulated flow, *Runoff, *Seasonal variation, *Water currents, Buoyancy forcing, Eddies, Freshwater runoff, Mathematical models, St Lawrence Estuary, Water circulation.

The seasonal current fluctuations recorded from May to September 1979 in the Lower St Lawrence Estuary (LSLE) were re-examined using complex empirical orthogonal functions analysis. The first mode explained 88% of the seasonal variability, and revealed the presence of an estuary-wide anticyclonic eddy near the mouth, which lasted for 40 days in June and July. Careful inspection of the (regulated) freshwater runoff and salinity time series indicated that light surface water pulses from the St Lawrence River and the Saguenay fjord arrived in the LSLE during that time. Their duration was about 40 days. The contention is that the anticyclonic eddy results from buoyancy forcing by these light water pulses, isolated in the LSLE by denser waters upwelled upstream and by the buoyancy front at the mouth. A reduced gravity model is used to show that when the width of the LSLE becomes greater than two internal Rossby radii, an initial dynamic height elevation will adjust through geostrophy to an anticyclonic eddy. This seems to occur downstream of Rimouski. In the absence of instabilities in the current field, the eddy will conserve potential energy for extended periods of time. During August, the advected river runoff decreased, unstable wave activity developed, and denser Gulf waters entered LSLE from the north shore producing a cyclonic eddy near the mouth. Concurrent satellite thermal imagery tends to support these findings. (Author's abstract)
W91-06765

IMPACT OF FRESHWATER RUNOFF ON PHYSICAL OCEANOGRAPHY AND PLANKTON DISTRIBUTION IN A WESTERN NORWEGIAN FJORD: AN EXPERIMENT WITH A CONTROLLED DISCHARGE FROM A HYDROELECTRIC POWER PLANT.
Bergen Univ. (Norway). Dept. of Marine Biology.
S. Kaartvedt, and H. Svendsen.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 381-395, October 1990. 11 fig, 4 tab, 23 ref.

Descriptors: *Estuaries, *Fjords, *Hydroelectric plants, *Norway, *Plankton, *Regulated flow, *Runoff, *Saline-freshwater interfaces, *Water circulation, Flow discharge, Flow rates, Freshwater runoff, Oceanography.

Investigations were carried out in a 20-km long fjord branch prior to, during, and after a 51-h controlled discharge from a hydroelectric power plant. The freshwater runoff (230 cu m/s) generated an estuarine circulation which was most prominent along the mid-axis of the fjord. High velocities were recorded both in the outgoing surface current, with a maximum of 1 m/s (10 km downstream of the power plant), and in a compensatory current (registration at 10-m depth) with a maximum of 0.6 m/s (3 km downstream). Velocities were low at 5-m depth. During discharge, salinity increased in the surface layer and decreased at a depth of several meters because of more extensive mixing. Phytoplankton was partly flushed out in the upper layers throughout the fjord branch, but abundance increased in deeper layers in an outer station, and the horizontal patchiness increased. The vertical center of zooplankton biomass descended significantly during plant operation. Biomass maxima in the ingoing compensation current indicate net zooplankton import during power plant operation, but no change in total zooplankton biomass in the fjord branch was found during this experiment. (Author's abstract)
W91-06766

FINE-GRAINED SEDIMENT TRANSPORT AND SORTING BY TIDAL EXCHANGE IN XIANGSHAN BAY, ZHEJIANG, CHINA.
National Bureau of Oceanography, Hangzhou (China). Second Inst. of Oceanography.
S. Gao, Q. C. Xie, and Y. J. Feng.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 397-409, October 1990. 6 fig, 4 tab, 15 ref.

Descriptors: *China, *Estuaries, *Estuarine sediments, *Sediment transport, *Suspended sediments, *Tidal effects, Neap tides, Sediment sorting, Spring tides, Water circulation, Xiangshan Bay, Zhejiang.

During the winter of 1983, 25-h measurements of current speed, flow direction, water depth and suspended sediment concentration were carried out at six stations located in the inlet section of Xiangshan Bay, during spring and neap tides. An analysis of the data obtained shows that tidal exchange, in the form of either vertical residual circulation of bay-mouth water mixing, is responsible for the observed net landward movement of suspended sediment, though the ebb currents are stronger than the flood currents in the inlet. The analysis suggests also that the tidal exchange processes, in combination with the settling behavior of the suspended sediments and the morphological features of the inlet section, lead to a marked sorting of the fine-grained sediments with the clay-like material predominating in the inner part of the bay and the silty material in the outer part. (Author's abstract)
W91-06767

COMPOSITION, SEASONALITY AND ABUNDANCE OF FISHES IN THE SHATT AL-BASRAH CANAL, AN ESTUARY IN SOUTHERN IRAQ.
Basrah Univ. (Iraq). Dept. of Fisheries and Marine Resources.
N. K. Al-Daham, and A. Y. Yousif.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 411-421, October 1990. 3 fig, 3 tab, 32 ref.

Descriptors: *Canals, *Estuarine fisheries, *Fish populations, *Iraq, *Shatt Al-Basrah Canal, *Species composition, Population density, Seasonal variation, Species diversity.

A total of 8245 fishes (226.3 kg) from 47 species were captured over the 12-month period beginning in February 1985 in the Shatt Al-Basrah Canal, a sub-tropical man-made estuary in Southern Iraq.

The most abundant species was Liza subviridis, comprising 59.6% of the total number and 40% of the total weight. Acanthopagrus latus, Thryssa malabarica and Aspius vorax together formed 17.7% of the total number and 14.5% of the total weight. The total number of individuals rose in spring with a peak in April. Numbers of species fluctuated from eight in January to 33 in September. Examination of fish species associations indicated that there were more species in the seasonal (17) and occasional (24) components and fewer in the regular (6) component. The species richness index was greatest from June to October, with a peak of 5.32 in September, and was lowest, 1.33-1.87, from January to April. The Shannon-Wiener diversity index ranged from 0.49 in March to 2.84 in September for numbers, and from 0.74 in January to 2.63 in September for biomass. The relative diversity index fluctuated from 0.09 in March to 0.47 in September for numbers, and from 0.14 to 0.43 for biomass for the same months. The evenness index varied from 0.07 in March to 0.50 in September. (Author's abstract)
W91-06768

ABUNDANCE AND BIOMASS OF HERBIVOROUS ZOOPLANKTON OFF KINGSTON, JAMAICA, WITH ESTIMATES OF THEIR ANNUAL PRODUCTION.
Guelph Univ. (Ontario). Dept. of Zoology.
C. Clarke, and J. C. Roff.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 423-437, October 1990. 3 fig, 4 tab, 47 ref.

Descriptors: *Biomass, *Coasts, *Jamaica, *Marine animals, *Zooplankton, Aquatic productivity, Herbivorous zooplankton, Kingston, Lime Cay, Marine environment, Population density, Species composition, Tropical regions.

During 1985-86 weekly collections of zooplankton were made off of Lime Cay, Jamaica, which is representative of the cay area off of southern Jamaica. The dominant (non-copepod) herbivorous taxa, Larvacea, Thaliacea, Cladocera and Pteropoda, were enumerated, and their daily biomasses were estimated by direct weighing or from length-weight regressions. The dominant taxa, in abundance, were the Oikopleuridae and Fritillaridae (49.8% and 35.8%, respectively), but the dominant taxon in terms of biomass was Thalia democratica, on average 72% of the total. These herbivorous taxa generally exhibited pronounced variations in abundance which, with the exception of an inverse relationship between Fritillaria spp. and the picoplankton, were not correlated with any size fraction of the phytoplankton. Calculations suggested that, in total, these 'other' herbivorous groups may equal the copepods in terms of annual production, and may on occasions exceed them by nearly three-fold. (Author's abstract)
W91-06769

RADIUM AND RADON IN CHARLOTTE HARBOR ESTUARY, FLORIDA.
Geological Survey, Tampa, FL.
For primary bibliographic entry see Field 5B.
W91-06770

COUPLED PHYSICAL-BIOLOGICAL PELAGIC MODEL OF A SHALLOW SILL FJORD.
Bergen Univ. (Norway). Dept. of Marine Biology.
D. L. Aksnes, and U. Lie.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 459-486, October 1990. 9 fig, 9 tab, 50 ref.

Descriptors: *Estuaries, *Estuarine environment, *Fjords, *Model studies, *Norway, *Plankton, Aquatic productivity, Biomass, Lindaspollene, Mathematical models, Meteorology, Nutrients, Seasonal variation, Simulation analysis, Stratification, Water chemistry.

A vertically resolved model for the land-locked fjord Lindaspollene in western Norway is presented. Salinity, temperature, oxygen, nitrogen-nutrients, silicate, and two groups of phytoplankton and herbivores are represented as dynamic variables. From 'below' the model is driven by solar radiation, precipitation, wind and tidal exchange and from 'above' by herbivore mortality. Comparison of simulation results and actual observations indicated that the main seasonal and vertical characteristics of the phytoplankton and herbivore dynamics are well reflected by the model, and realistic seasonal patterns may be produced for several successive years. The most characteristic vertical features are the formation of a summer surface production maximum and a deep chlorophyll maximum. Furthermore, an herbivore biomass which develops in the surface layer divides into a shallow and a deep component during summer and becomes concentrated in the surface layer again in the autumn. The nutricline and the pycnocline develop independently of one another, with consequences for the supply of nutrients to the upper euphotic zone. The bottom-up control exerted by the meteorological forcing, especially the freshwater runoff, seems to be of paramount significance for the observed vertical structure and seasonality of the present fjord system. (Author's abstract)
W91-06771

RESUSPENSION IN THE KATTEGAT: IMPACT OF VARIATION IN WIND CLIMATE AND FISHERY.
Uppsala Univ. (Sweden). Naturgeografiska Inst.
S. Floderus, and L. Pihl.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 487-498, October 1990. 9 fig, 1 tab, 40 ref.

Descriptors: *Climatic changes, *Coasts, *Marine fisheries, *Sediment distribution, *Sediment transport, Eutrophication, Kattegat Sea, Marine sediments, Resuspension, Seasonal variation, Suspended sediments, Trawling, Wind waves.

The recurrence of various agents of fine sediment resuspension in the Kattegat Sea, notably wind-induced wave action and demersal trawling, and their seasonal variation and long-term trends have been estimated. A comparison between the sediment-water interface and the spatial distribution of theoretical wind/wave impact indicated that the sediment is resuspended by further agents at depths below the permanent halocline between 10 and 20 m depth. The climatic deterioration in 1940-70 had a significant influence on the recurrence of wind-induced resuspension, although this was mostly limited to a 10-30% shortening of the recurrence period. On the other hand, a quantification of the effect of demersal trawling in the same period suggests a total shortening of recurrence at bottoms below the halocline by 75-85% in the autumn and winter, and by one order of magnitude (90%) in spring and summer, compared with the effect of waves only in the 1930s; resuspension caused by near-bottom unidirectional currents was not quantified. At these deeper bottoms, resuspension conditions have approached those prevailing at shallow bottoms above the halocline. (Author's abstract)
W91-06772

TOXICITY TO ESTUARINE ORGANISMS OF LEACHATES FROM CHROMATED COPPER ARSENATE TREATED WOOD.
New Jersey Medical School, Newark. Dept. of Anatomy.
For primary bibliographic entry see Field 5C.
W91-06782

3-D MAPPING OF DISSOLVED OXYGEN IN MAR PICCOLO: A CASE STUDY.
Support Group, Fremont, CA.
For primary bibliographic entry see Field 5C.
W91-06802

SALT-MARSH GROWTH AND STRATIFICATION: A NUMERICAL MODEL WITH SPECIAL REFERENCE TO THE SEVERN ESTUARY, SOUTHWEST BRITAIN.
Reading Univ. (England). Postgraduate Research Inst. for Sedimentology.
J. R. L. Allen.
Marine Geology MAGEA6, Vol. 95, No. 2, p 77-96, 1990. 19 fig, 1 tab, 88 ref.

Descriptors: *Estuarine environment, *Model studies, *Mud flats, *Salt marshes, *Stratification, *Tidal marshes, *Wetlands, Coasts, Deposition, England, Erosion, Intertidal areas, Model testing, Numerical analysis, Peat, Sea level, Sedimentation, Simulation analysis, Tidal flats.

Numerical modeling is one way to improve understanding of the growth and response to external factors of high tidal mudflats and marshes. Theoretically, mudflat-marsh growth is determined by the rates of minerogenic and organogenic sedimentation, the rate of change and tendency of relative sea-level, and the rate of long-range sediment compaction. A numerical simulation model for mudflat-marsh growth using these ideas has been implemented for the Severn Estuary on the basis of empirical knowledge of its tidal and fine-sediment regimes and of the present-day order of magnitude of the deposition rate of fine sediment in its upper intertidal zone. The predicted curve of vertical growth relative to the tidal frame at first rises very steeply but thereafter flattens rapidly. Its precise form depends on the balance between the terms of the governing equation. When relative sea-level is rising, a marsh may grow, after a certain maturation time, to a stable elevation in the moving tidal frame. This elevation is substantially less than the elevation of the extreme tide, a situation that could inhibit peat formation. When the tendency of relative sea-level is downward, or when the rate of organogenic sedimentation is sufficiently large, a marsh after a certain emergence time may rise above the tidal frame, with the consequence that peat growth is favored. The exploratory model is supported by a published growth curve for tidal marshes in eastern England, and by the observed internal stratification and relative elevations of the salt marshes developed along the Severn Estuary. (Author's abstract)
W91-06815

MORPHOLOGY, SEDIMENTOLOGY, AND TIDAL CHANNEL PROCESSES ON A HIGH-TIDE-RANGE MUDFLAT, WEST COAST OF SOUTH KOREA.
North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences.
J. T. Wells, C. E. Adams, Y. A. Park, and E. W. Frankenberg.
Marine Geology MAGEA6, Vol. 95, No. 2, p 111-130, 1990. 15 fig, 47 ref. National Science Foundation (NSF) Grant INT 8509742 and Korea Science and Engineering Foundation Grant KOSEF 1986-1988.

Descriptors: *Channel morphology, *Channels, *Coasts, *Intertidal areas, *Mud flats, *Sediment transport, *Tidal effects, *Tidal flats, Drainage patterns, Erosion, Field tests, Korea, Monsoons, Sedimentation, Sediments, Surges, Terrace channels, Tidal currents, Tributaries.

Most of the west coast of Korea is fronted by broad intertidal sand and mudflats which have formed in a high-tide-range environment that is subjected periodically to intense winter season surges from monsoonal winds. The lack of a large source of sediments and the absence of a protective barrier at their seaward margins makes these tidal flats unusual. Field studies were undertaken for the purpose of describing the morphology of tidal channels and the surrounding tidal flat surfaces and assessing the role of tidal channels in sedimentation processes. The results of the investigation revealed a highly variable morphology with locally dense drainage channel networks. North-south transects showed that the intertidal surface was actually terraced by step-like changes in elevation at three of the channels. While the northern, terraced tidal flat was characterized by muddy sediments and tightly meandering tributary channels, the southern region contained coarser sediments and lacked tributary channels. Most channels appeared to be ebb dominated. A record of the first summer (monsoonal) storm showed enhanced ebb flows and transparency values near zero between peak ebb and peak flood. The combined erosion by storms and daily dispersal by channelized ebb currents

requires a substantial return of sediments in order for the tidal flats to maintain their elevation. The apparent lack of bathymetric relief in the subtidal region indicates that either sediments carried seaward in ebb channels are removed by shelf processes or are simply reintroduced to the intertidal region by flood currents. (Author's abstract)
W91-06816

INTERNAL HYDRAULICS OF A SEDIMENT-STRATIFIED CHANNEL FLOW.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
C. E. Adams, J. T. Wells, and Y. A. Park.
Marine Geology MAGEA6, Vol. 95, No. 2, p 131-145, 1990. 9 fig, 1 tab, 34 ref. National Science Foundation (NSF) Grants INT-8509742 and OCE-8216144.

Descriptors: *Channel flow, *Coasts, *Mud flats, *Sediment transport, *Stratified flow, *Suspended sediments, *Yellow Sea, Boundary layers, Channel morphology, Channels, Deposition, Flow velocity, Hydraulic jump, Korea, Model studies, Numerical analysis, Sediment load, Stratification, Surges, Turbidity, Turbidity currents, Velocity, Vertical distribution, Waves.

Mudflats along the macrotidal Yellow Sea coast of South Korea are incised by numerous channels that act as drainage and sediment dispersal routes, primarily during ebb flows. Observations in two channels at maximum ebb revealed stable vertical distributions of suspended sediments (density) capped by a lutocline at mid-depth, across which suspended-sediment-related density varied rapidly. Internal responses, as revealed by turbidity and velocity data, varied with flow, suspended sediment, and morphology. At one location, upstream-propagating lowest mode internal waves with period T=140 s were observed. Superimposed on the interfacial waves were higher frequency Kelvin-Helmholtz billows, apparently related to mean flow shear. Visual observations indicated that billows filled the channel from surface to bottom. At the second location, an undulatory jump consisting of a series of surges was observed. Each surge resembled the head of a turbidity current. Kelvin-Helmholtz billows were present, but only at surge crests and troughs. Internal hydraulic jumps, sediment spilling from feeder channels, and collapse of instabilities may contribute to wave generation. A range of bottom sediment sizes permits the development of a stable stratification within the bottom boundary layer beneath a lutocline. A simple numerical model showed that the lutocline is the upper limit of a boundary layer with a thickness proportional to mean flow velocity and to the intensity of suspended-sediment stratification within the layer. Billows appear to enhance resuspension of sediment, thereby increasing load and thickness of the boundary layer. Locations of hydraulic jumps appear to be sites of deposition. (Author's abstract)
W91-06817

DISSOLVED ORGANIC MATTER AND UV ABSORPTION IN A TROPICAL HYPERHALINE ESTUARY.
Centre de Recherches Oceanographiques de Dakar-Thiaroye (Senegal).
J. Pages, and F. Gadel.
Science of the Total Environment STENDL, Vol. 99, No. 1/2, p 173-204, December 1990. 11 fig, 8 tab, 135 ref, 1 append.

Descriptors: *Analytical methods, *Analytical techniques, *Casamance River, *Dissolved organic carbon, *Dissolved solids, *Estuaries, *Estuarine environment, *Tropical regions, Closed systems, Distribution patterns, Hydraulics, Nutrients, Phytoplankton, Primary productivity, Seasonal variation, Senegal, Spatial distribution, Spectral analysis, Swamps, Tidal effects, Ultraviolet radiation.

Dissolved organic matter (DOM) plays an important role in aquatic ecosystems. Besides its sheer size on a global level, the DOM pool is also important as a potential nutrient source, particularly in a closed or confined ecosystem. The assessment of DOM concentration is often difficult using either chemical or photochemical processes. However, it has been shown that the assessment of aquatic DOM may be possible by optical measurements in the ultraviolet (UV) range. Recently, several DOM surveys were carried out in the Casamance River, a hyperhaline estuary in Senegal in which light absorption by water in the near UV was measured. The results of the surveys revealed that the upstream portion of the estuary was hydraulically isolated. Calculations of dissolved organic carbon concentrations (DOC) and mean molecular weight (MW) were high. Dissolved organic matter originated mostly from Phragmites swamps, and was concentrated during the dry season, despite flocculation and photolysis. New, more labile DOM was brought in during the rains. The seaward portion of the estuary received high to medium molecular weight DOM from mangrove swamps, and lost some of it to the sea by tidal transport. In the estuary's median portion, low molecular weight DOM originated from phytoplankton. The aquatic primary production in the estuary could partly be explained by the DOM distributions. (Korn-PTT)
W91-06821

ECONOMIC VALUE OF WETLANDS-BASED RECREATION.
Georgia Univ., Athens. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W91-06831

STRUCTURE OF VERTICAL CURRENT PROFILES IN A MACROTIDAL, PARTLY-MIXED ESTUARY.
Plymouth Marine Lab. (England).
R. J. Uncles, and J. A. Stephens.
Estuaries ESTUDO, Vol. 13, No. 4, p 349-361, December, 1990. 5 fig, 24 ref, append.

Descriptors: *England, *Estuaries, *Hydrodynamics, *Saline-freshwater interfaces, *Tidal currents, *Tidal hydraulics, Gravity flow, Mixing, Model studies, Stratification, Tamar Estuary, Vertical flow, Viscosity, Water column, Water currents.

A local, one-dimensional, depth-dependent model is used in conjunction with a one-dimensional, longitudinal, hydrodynamical model to examine the mechanisms affecting vertical profiles of longitudinal residual current in the macrotidal (tidal range typically exceeds 4 m during spring tides), partly-mixed Tamar Estuary (England). Residual currents are simulated at a deep (15 m) station in the lower reaches, which possesses a small tidal amplitude to depth ratio and a non-zero salinity throughout the tidal cycle, as well as at a shallow station in the upper reaches, which varies in depth from 1 m at low water, when salinity is zero, to 5 m at high water. A slow, up-estuary current dominates the residual circulation just beneath the high water level at the deeper station. Further down the water column a down-estuary residual current develops which is the near-surface component of a two-layer gravitational circulation. The up-estuary component of this gravitational circulation occurs deeper in the column and extends to the bed at the deep station, whereas at the shallow station it is eventually dominated by a down-estuary current in the bottom 1 m. Simulated residual currents are fairly insensitive to estuary-bed slope and to observed depth variations in longitudinal density gradient. Residual current profiles of the observed form can only be generated by a longitudinal density gradient. The reduction in vertical eddy viscosity by water column stability due to stratification is an essential requirement for producing a strong gravitational circulation of the observed magnitude. Stratification at the shallow station is much higher during the ebb than during the flood and this asymmetry enhances the gravitational circulation in the upper reaches. The formation of residual flows at both stations is illustrated by showing time-series data over a tidal cycle for the simulated current profiles. (Author's abstract)
W91-06832

SEA LEVEL VARIABILITY IN LONG ISLAND SOUND.
Delaware Univ., Newark. Coll. of Marine Studies.
K. C. Wong.
Estuaries ESTUDO, Vol. 13, No. 4, p 362-372, December, 1990. 12 fig, 1 tab, 13 ref.

Descriptors: *Estuaries, *Long Island Sound, *Model studies, *Sea level, *Tidal hydraulics, *Wave direction, Tidal currents, Wind-driven currents.

Sea level variability in Long Island Sound is examined at both tidal and subtidal frequencies over a 1 year period. The sound is found to be decoupled effectively from the lower Hudson Estuary at tidal frequencies. The predominantly semidiurnal tides in the sound are forced by the oceanic tides transmitted from the mouth. There is a fourfold amplification of the semi-diurnal tides within the sound due to resonance. Diurnal tides are much weaker in the sound, and there is also no evidence of significant amplification in the interior. At subtidal frequencies, the pressure-adjusted sea level in the interior of the sound is forced by a combination of co-oscillation with coastal sea level at the mouth and direct setup induced by local wind forcing over the surface of the sound. Because the longitudinal axis of Long Island Sound is roughly aligned with the open coast from Montauk Point to Sandy Hook, these two mechanisms work in concert to produce larger subtidal sea level fluctuations in the western sound relative to those in the eastern sound. A linearized, frequency-dependent analytical model is developed to aid interpretation of field observations. The simple analytical model developed is a useful tool for the understanding of the basic response characteristics of the sound at both tidal and subtidal frequencies. While such a simple model does not capture all the details in the response characteristics, the model does seem to give a good representation about the essence of the response. (Author's abstract)
W91-06833

REDIVERSION SALINITY CHANGE IN THE COOPER RIVER, SOUTH CAROLINA: ECOLOGICAL IMPLICATIONS.
South Carolina Univ., Columbia. Marine Science Program.
P. M. Bradley, B. Kjerfve, and J. T. Morris.
Estuaries ESTUDO, Vol. 13, No. 4, p 373-379, December, 1990. 4 fig, 1 tab, 25 ref.

Descriptors: *Environmental effects, *Estuaries, *Estuarine environment, *Global warming, *Marsh plants, *Plant populations, *Saline water intrusion, *South Carolina, *Stream diversion, Cooper River Basin, Mixing, Model studies, Plant communities, Saline-freshwater interfaces.

A 70% reduction in fresh water discharge through the Cooper River Basin, South Carolina, has provided a unique opportunity to study changes in estuarine plant communities in response to a system-wide increase in salinity. A one-dimensional tidal prism mixing model was used to simulate the changes in the longitudinal salinity distribution which have occurred in the Cooper River since a diversion in 1985 reduced the mean flow from 442 to 130 cubic m/s. Model simulations indicate that a salinity increase of 10-14 ppt has occurred in the region of the river where the marsh plant community shifts from a virtual monoculture of Spartina alterniflora to a more diverse brackish community. The flow reduction and associated salinity increase are expected to result in an increased dominance of the halophyte, S. alterniflora, and a progressive exclusion of the less halotolerant species which currently inhabit this region. (Author's abstract)
W91-06834

MARSH-WATER COLUMN INTERACTIONS IN TWO LOUISIANA ESTUARIES. I. SEDIMENT DYNAMICS.
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
For primary bibliographic entry see Field 2J.
W91-06836

MARSH-WATER COLUMN INTERACTIONS IN TWO LOUISIANA ESTUARIES. II. NUTRIENT DYNAMICS.
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
D. L. Childers, and J. W. Day.
Estuaries ESTUDO, Vol. 13, No. 4, p 404-417, December, 1990. 6 fig, 4 tab, 58 ref.

Descriptors: *Estuaries, *Estuarine sediments, *Louisiana, *Nutrient transport, *Wetlands, Barataria Basin, Carbon, Dissolved organic carbon, Flumes, Four League Bay, Nitrogen, Phosphorus, Salt marshes, Water column.

The exchange of dissolved nutrients between marshes and the inundating water column was measured using throughflow marsh flumes built in two microtidal Louisiana estuaries. The flumes were sampled between September 1986 and April 1988, after an extended period of low sea level on the Louisiana coast. The Barataria Basin estuary is in the later, deteriorating stage of deltic cycle. Its subsiding marshes supplied dissolved organic nitrogen (DON), inorganic nitrogen (DIN), dissolved organic carbon (DOC), and total Kjeldahl nitrogen (TKN) to the water column. The export of DIN is probably related to marsh deterioration in the late stages of deltic development. Coastal brackish marshes of Fourleague Bay, a marsh system in an early, developmental stage of the deltic cycle, exported TKN to the open water estuary in all samplings. This marsh apparently acted as a short-term buffer of DIN by taking up NH4 in spring when baywide concentrations were high, and supplying DIN to the estuary in summer and fall when concentrations in the bay were lower. Differences in phosphorus (P), DOC, and DON fluxes between these two estuaries were also observed. The Fourleague Bay site exported P and imported DOC. This P export may be related to remobilization of sediment-bound riverine P by the reducing soils of the marshes. Fluxes of P at the Barataria Basin sites were variable and low while DOC was imported. Most imports of dissolved nutrients were correlated with higher upstream source concentrations, and flux rates were fairly consistent throughout the tide. However, dissolved nutrient exports did not correlate with upstream concentrations, and in many cases the flux was dominated by early flood tide nutrient release. This pulsed behavior may be caused by rapid diffusion from the sediments early in the tidal cycle, when the sediment-water concentration gradient is largest. Interestuary differences were also seen in particulate organic matter fluxes, as the Fourleague Bay marsh exported POC and PON during all samplings while Barataria Basin imported these nutrients. In general, the magnitude and direction of nutrient exchanges seems to reflect the deltic stage of the estuary. (See also W91-06836) (Doyle-PTT)
W91-06837

CONTROL OF NUTRIENT CONCENTRATIONS IN THE SEEKONK-PROVIDENCE RIVER REGION OF NARRAGANSETT BAY, RHODE ISLAND.
Rhode Island Univ., Narragansett. Marine Ecosystems Research Lab.
P. H. Doering, C. A. Oviatt, and M. E. Q. Pilson.
Estuaries ESTUDO, Vol. 13, No. 4, p 418-430, December, 1990. 8 fig, 8 tab, 36 ref.

Descriptors: *Carbon, *Estuaries, *Nitrogen, *Nutrient transport, *Nutrients, *Path of pollutants, *Phosphates, *Rhode Island, Mixing, Model studies, Narragansett Bay, Nutrient concentrations, Saline-freshwater interfaces, Salinity, Silicon, Water column.

Six synoptic samplings of nutrient concentrations of the water column and point-source inputs (rivers, sewage treatment plants) were conducted in the Seekonk-Providence River region of Narragansett Bay. This region is surrounded by the greater Providence metropolitan area and is responsible for an estimated 60% of total dissolved organic nitrogen loading to the bay. Concentrations of nutrients (NH4, NO2 + NO3, PO4, dissolved silicon, particulate N, particulate C) were predicted using a conservative, two-layer box model in order to assess the relative influence of external inputs and internal processes on observed concentrations. Although most nutrients were clearly affected by processes internal to the system, external input and mixing explained most of the variability in and absolute magnitude of observed concentrations, especially for dissolved constituents. The salinity of bottom water always exceeded that near the surface, while dissolved nutrients exhibited an opposite trend. In the bay as a whole, two functionally distinct regions can now be identified: the Seekonk-Providence River, where dissolved nutrient concentrations are externally controlled and the lower Narragansett Bay where internal processes regulate the behavior of nutrients. A preliminary nitrogen budget suggests that the Seekonk-Providence River acts as a conduit passing some 95% of the nitrogen entering the system via point sources and bottom water from upper to lower Narragansett Bay, and that control of point sources would substantially improve water quality in this already degraded region. (Doyle-PTT)
W91-06838

SECONDARY PRODUCTION WITHIN A SEAGRASS BED (ZOSTERA MARINA AND RUPPIA MARITIMA) IN LOWER CHESAPEAKE BAY.
Virginia Inst. of Marine Science, Gloucester Point.
T. J. Fredette, R. J. Diaz, J. van Montfrans, and R. J. Orth.
Estuaries ESTUDO, Vol. 13, No. 4, p 431-440, December, 1990. 2 fig, 4 tab, 26 ref. United States Environmental Protection Agency, Chesapeake Bay Program Grant No. R805974.

Descriptors: *Aquatic plants, *Chesapeake Bay, *Estuaries, *Estuarine environment, *Productivity, *Sea grasses, *Secondary productivity, Amphipods, Crustaceans, Decapods, Distribution patterns, Isopods, Population density, Species composition.

Monthly sampling of a 140-ha seagrass bed in the lower Chesapeake Bay, Virginia, revealed that 13 numerically and trophically important species, representing about 20% of the total community densities over the year-long study period, accounted for the production of approximately 42 g dry wt/sq m/yr. This estimate is likely conservative due to assumptions on voltinism and fixed size at maturity regardless of season for the species studied. The isopod Erichsonella attenuata accounted for 17.6 g dry wt/sq m/yr or 42% of the calculated total production, while the portunid decapod Callinectes sapidus and amphipod Grammarus mucronatus each accounted for 7.7 g dry wt/sq m/yr. The 10 remaining species (4 peracarids, 4 molluscs, and 2 decapods) each produced less than 2 g dry wt/sq m/yr. Total seagrass-associated secondary production was estimated to equal or exceed 200 g dry wt/sq m/yr. By applying this estimate to the entire 140-ha grassbed, an average of 4.8 metric tons dry wt of invertebrate standing stock and 55.9 metric tons of invertebrate production is projected to occur over the year. (Author's abstract)
W91-06839

LIGHT ATTENUATION AND SUBMERSED MACROPHYTE DISTRIBUTION IN TIDAL POTOMAC RIVER AND ESTUARY.
Geological Survey, Reston, VA.
V. Carter, and N. B. Rybicki.
Estuaries ESTUDO, Vol. 13, No. 4, p 441-452, December, 1990. 8 fig, 3 tab, 47 ref.

Descriptors: *Aquatic plants, *Estuaries, *Estuarine environment, *Light effects, *Light penetration, *Macrophytes, *Potomac River, Chlorophyll a, Distribution patterns, Population density, Sediment-water interfaces, Suspended solids, Tidal range, Turbidity, Water column.

Changing light availability may be responsible for the discontinuous distribution of submerged aquatic macrophytes in the freshwater tidal Potomac River. During the 1985-1986 growing seasons, light attenuation and chlorophyll a and suspended particulate material concentrations were measured in an unvegetated reach (B) and in two vegetated reaches (A and C). Light attenuation in reach B (the lower, fresh to oligohaline tidal river) was greater than that in reach A (the recently revegetated, upper, freshwater tidal river) in both years. Reach B attenuation was greater than that in reach C (the vegetated, oligohaline to mesohaline transition zone of the Potomac Estuary) in 1985 and similar to that in reach C in 1986. In reach B, 5% of the total below-surface light penetrated only an average of 1.3 m in 1985 and 1.0 m in 1986, compared with 1.9 m and 1.4 m in reach A and B in 1985 and 1986 respectively. Water column chlorophyll a concentration controlled light availability in reaches A and B in 1985, whereas both chlorophyll a and suspended particulate material concentrations were highly correlated with attenuation in both reaches in 1986. Reach C light attenuation was correlated with suspended particulate material in 1986. The relationship between attenuation coefficient and Secchi depth was K par = 1.38/Secchi depth (where K par is the photosynthetically active radiation). The spectral distribution of light at 1 m was shifted toward the red portion of the visible spectrum compared to surface light. Blue light was virtually absent at 1.0 m in reach B during July and August 1986. Tidal range is probably an important factor in determining light availability for submersed macrophyte propagule survival at the sediment-water interface in this shallow turbid system. (Author's abstract)
W91-06840

IMMIGRATION OF LARVAE OF FALL/WINTER SPAWNING MARINE FISHES INTO A NORTH CAROLINA ESTUARY.
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
S. M. Warlen, and J. S. Burke.
Estuaries ESTUDO, Vol. 13, No. 4, p 453-461, December, 1990. 6 fig, 2 tab, 38 ref.

Descriptors: *Estuaries, *Estuarine fisheries, *Fish migration, *Fish populations, *North Carolina, Beaufort Inlet, Eel, Larvae, Menhaden, Newport River, Population density, Seasonal distribution, Spawning, Species composition, Spot croakers, Temporal distribution.

Larval fishes were sampled weekly from late fall to early spring in the Newport River estuary just inside Beaufort Inlet, North Carolina. Quantitative samples were taken during darkness at mid-flood tide with paired 60-cm bongo nets (505 micro meter mesh). Larvae of 22 species from 15 families were collected. Seventy-seven percent of the species and 97% of the individuals were fishes that had been spawned on the continental shelf and had immigrated to the estuary. In descending order, the five most abundant species, accounting for 90% of the individuals, were spot (Leiostomus xanthurus), Atlantic croaker (Micropogonias undulatus), Atlantic menhaden (Brevoortia tyrannus), pinfish (Lagodon rhomboides), and speckled worm eel (Myrophis punctatus). Most species immigrated throughout the winter and into the spring since predation pressure on immigrating larvae is minimal during winter. While there were distinct seasonal patterns in the temporal abundances of species, the long with-in year period of immigration provides a buffer against recruitment failure during short term unfavorable extremes in environmental factors. (Doyle-PTT)
W91-06841

INTERTIDAL DISTRIBUTION AND FEEDING HABITS OF THE MUD CRAB, EURYTIUM LIMOSUM.
Georgia Univ., Sapelo Island. Marine Inst.
R. T. Kneib, and C. A. Weeks.
Estuaries ESTUDO, Vol. 13, No. 4, p 462-468, December, 1990. 6 fig, 2 tab, 22 ref. National Science Foundation Grant No. OCE-8715449.

Descriptors: *Crabs, *Crustaceans, *Estuaries, *Estuarine environment, *Estuarine fisheries, *Georgia, *Killifish, *Predation, Distribution patterns, Feeding rates, Fish populations, Population density, Salt marshes, Sapelo Island.

The intertidal distribution and feeding habits of Eurytium limosum in the salt marsh around Sapelo

Island, Georgia and the potential importance of this mud crab as a predator on young killifish (Fundulus herteroclitus) that use the intertidal marsh surface as a nursery habitat was determined. Average summer densities of the xanthid crab, Eurytium limosum, in the intertidal salt marsh on Sapelo Island were in the range of 7.5 to 80.0 individuals per sq m. Crab densities were lowest in wet, low lying marsh and highest in well-drained creek bank and mussel mound habitats. An analysis of crab stomach contents indicated that feeding occurred mostly around high tide, especially at night. Although the diet included some plant material, Eurytium limosum is primarily predatory and consumed crabs, polychaetes, ostracods, bivalves, and snails. In the laboratory, under simulated low-tide field conditions, both small (11-15 mm carapace width) and large (20-37 mm CW) Eurytium could capture and consume young killifish (Fundulus heteroclitus). Large crabs consumed the entire size range (7-19 mm total length) of larval/juvenile fish offered, but small crabs did not prey upon fish $>$ 11.5 mm in length. The potential importance of E. limosum as a predator on young killifish may not be realized in the field because alternative prey are available and the crabs feed primarily at high tide, when young killifish are dispersed in the water column and are less vulnerable to benthic predators. (Author's abstract)
W91-06842

SPATIO-TEMPORAL FLUCTUATIONS IN THE DISTRIBUTION AND ABUNDANCE OF DEMERSAL FISH AND EPIBENTHIC CRUSTACEANS IN YAQUINA BAY, OREGON.
Environmental Research Lab.-Narragansett, Newport, OR. Mark O. Hatfield Marine Science Center.
W. A. De Ben, W. D. Clothier, G.R. Ditsworth, and D. J. Baumgartner.
Estuaries ESTUDO, Vol. 13, No. 4, p 469-478, December, 1990. 4 fig, 5 tab, 48 ref.

Descriptors: *Crustaceans, *Estuaries, *Estuarine fisheries, *Fish populations, *Oregon, Crabs, Distribution patterns, Fish, Population density, Seasonal distribution, Shrimp, Species composition, Yaquina Bay.

An historical data set collected 20 years ago from the relatively undeveloped Yaquina Bay is described. In this data set the spatio-temporal variation in observed species composition and abundance of demersal fishes and epibenthic crustaceans along an estuarine gradient was investigated. A total of over 32,000 demersal fish and epibenthic crustaceans belonging to 62 species were caught in 42 biweekly trawls from 10 stations in the bay during 1967 and 1968. English sole, Parophrys vetulus, was the most abundant species. Seventeen species (13 fishes and 4 crustaceans) constituted 95% of the catch. Total numerical abundances of both individuals (mainly juvenile fishes) and species were greatest in the lower 12 km of the estuary during the summer and early fall, a period of water mass stability and increased water temperature and salinity. This section of the estuary is used by many immature fishes and crustaceans as a 'nursery area.' The fewest species were taken in January 1968 from the central, upper estuarine, and riverine areas of the bay, this being a time when high rainfall and river discharge result in low salinity and temperature, and fish emigration from the estuary. Crustaceans (shrimp and subadult crabs) were generally most abundant in late winter and early spring throughout the estuary. Changes in diversity indices reflected variations in community structure, the influence of migratory species and juvenile fishes, and seasonal changes in dominance. Year-to-year fluctuations in abundance may be due, in part, to local hydrographic and meteorological conditions along the central Oregon coast. (Author's abstract)
W91-06843

PRODUCTION AND LIFE CYCLE OF THE GASTROPOD HYDROBIA TRUNCATA, WITH NOTES ON SPURWINKIA SALSA IN MASSACHUSETTS SALT MARSH POOLS.
Northeastern Univ., Boston, MA. Dept. of Biology.
M. A. Mandracchia, and E. Ruber.
Estuaries ESTUDO, Vol. 13, No. 4, p 479-485, December, 1990. 3 fig, 3 tab, 31 ref.

Descriptors: *Estuaries, *Estuarine environment, *Gastropods, *Massachusetts, *Mollusks, *Salt marshes, *Wetlands, Distribution patterns, Life cycles, Parker River National Wildlife Refuge, Population density, Primary production, Salinity, Snails.

The hydrobiid gastropods are important components of the salt marsh pool invertebrate community at Parker River National Wildlife Refuge near Rowley, Massachusetts. Hydrobia truncata was found to be the dominant snail in the two higher salinity pools, with Spurwinkia salsa becoming the more important at lower salinities. H. truncata began to reproduce between May 19 and June 9. Cohorts lasted about 14 months, and 99% of production occurred during the first 12 months. Shell height in H. truncata was greater in pool 2 which had a much lower density than pool 1 on all dates of the 1980 growing season. Snail densities were positively correlated with the presence of floating algal mats of the genus Cladophora, but the snails apparently do not graze on this alga. H. truncata production, calculated by four methods, ranged from 41.0 to 78.1 and averaged 60.5 g/sq m/cohort for pool 1, but were estimated to be less than 10% of these values in pool 2. In pool 1, H. truncata was estimated to assimilate 55% of the net primary production or 28% of the total pool energy income when detritus income was included. When found in the same pool as H. truncata, Spurwinkia salsa ordinarily comprised less than 0.5% of the total snail population. S. salsa veligers did not metamorphose into juveniles until July and were partitioned from H. truncata by size during their first growing season. The main separation between the two species, however, appeared to be spatial, on a salinity gradient. The S. salsa cohort lasted about 19 months with a few individuals surviving to 27 months in their third summer. (Author's abstract)
W91-06844

FORECASTING THE ABUNDANCE OF THE SEA NETTLE, CHRYSAORA QUINQUECIRRHA, IN THE CHESAPEAKE BAY.
Maryland Univ., Solomons. Center for Environmental and Estuarine Studies.
D. G. Cargo, and D. R. King.
Estuaries ESTUDO, Vol. 13, No. 4, p 486-491, December, 1990. 2 fig, 3 tab, 26 ref.

Descriptors: *Chesapeake Bay, *Coelenterates, *Estuaries, *Estuarine environment, *Jelly fish, *Sea nettles, Forecasting, Life cycles, Model studies, Population density, Salinity, Streamflow, Temperature effects.

The sea nettle shows variable seasonal infestation in the Chesapeake Bay. Public interest in the medusal population prompted an examination of the effect of climatic, hydrographic, and biological variables on such changes. Visual medusal counts since 1960 were regressed in a step wise fashion against the suite of variables, to produce an abundance model which allows a reasonable prediction of the forthcoming summer's infestation. Streamflow in the entire Chesapeake watershed for the months of January through June and the water temperature for May were most important. Lower streamflow apparently provides a salinity regime which supports the sessile stages early in the year and allows the survival and rapid growth of ephyrae in early summer. Extensive field observation and laboratory experimentation show that the polyp stage thrives in a salinity range of 10-25 ppt. At salinities below 10 ppt their numbers diminish, and they are never found in the wild where salinity falls below 7 ppt. The water temperatures in May furnishe the trigger for strobilation at a propitious time. A cool spring delays development. Strobilation does not occur at temperatures below 18 C, but at 20-22C, it can be initiated and completed in 3-7 d, hence the importance of this variable. (Doyle-PTT)
W91-06845

GREAT LAKES ESTUARIES.
Ohio State Univ., Columbus. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W91-06846

DDT IN MYTILUS EDULIS: SPATIO-TEMPORAL VARIATIONS, IN THE PUNTA BANDA ESTUARY, BAJA CALIFORNIA, MEXICO.
Universidad Autonoma de Baja California, Mexicali (Mexico). Inst. de Investigaciones Oceanologicas.
For primary bibliographic entry see Field 5B.
W91-06883

CHARACTERIZATION AND CLASSIFICATION OF TIDAL MARSH SOILS AND PLANT COMMUNITIES IN NORTH-WEST SPAIN.
Universidad Politecnica de Madrid (Spain). Escuela Tecnica Superior de Ingenieros Agronomos.
P. Bascansa, and C. Roquero.
Catena, Vol. 17, No. 4/5, p 347-355, August/October 1990. 2 fig, 1 tab, 19 ref.

Descriptors: *Ecosystems, *Marsh plants, *Marshes, *Soil classification, *Soil properties, *Spain, *Tidal marshes, *Wetlands, Clays, Estuaries, Organic matter, Pyrite, Salinity, Spatial distribution, Sulfur, Tidal floods.

The soils and the vegetation of a mid-latitude tidal marsh located in the Ria of Betanzos (northwest Spain) and formed in the mouth of the Bajoy River have been studied. The distribution of plant communities and soil characteristics are clearly related to physiographic position. The measurement of some soil properties used in their classification indicates that necessary conditions for the formation and accumulation of sulfidic materials exist in these soils. The soils are saline and contain high levels of organic matter and sulfur, mainly as pyrite. They are potential acid sulfate clays, classified according to Soil Taxonomy as Sulfaquents and Hydraquents. The synsedimentary horizon build-up in the study area is only very slightly affected by post-sedimentary initial soil formation. Only partial, desalinization, incipient physical ripening and oxidation of sulfides has occurred. The pioneer vegetation, Spartinetum maritimae, colonizes silty deposits at the level of neap tide low water. From this level upward to spring tide high water level a succession of halophytic communities is associated with a succession of sedimentary deposits consisting of a base of permanently reduced Gr sulfidic horizons with progressively increasing contents of clay and organic matter towards higher levels, culminating in a G-Go-Gro-Gr profile in the zone of Juncus gerardi domain. Depth and duration of tidal floods seems to be the main ordering factor in the spatial distribution of plant communities. The actual vegetation hardly influences the incipient soil development and therefore the importance of the pioneering vegetation succession for the soil formation in the study area is predominantly their synsedimentary influence on the parent material. (Geiger-PTT)
W91-06905

DEVELOPMENT OF A TOXIC ALEXANDRIUM MINUTUM HALIM (DINOPHYCEAE) BLOOM IN THE HARBOUR OF SANT CARLES DE LA RAPITA (EBRO DELTA, NORTHWESTERN MEDITERRANEAN).
Instituto de Ciencias del Mar, Barcelona (Spain).
For primary bibliographic entry see Field 5B.
W91-06938

INFLUENCE OF TIDAL CONDITIONS AND RIVER VOLUME ON PHYTOPLANKTON DISTRIBUTION AND COMPOSITION IN THE PAS ESTUARY (NORTHERN SPAIN).
Cantabria Univ., Santander (Spain). Lab. de Ecologia.
L. Perez, and J. C. Canteras.
Scientia Marina, Vol. 54, No. 1, p 77-88, March 1990. 6 fig, 5 tab, 27 ref.

Descriptors: *Ecological distribution, *Estuarine environment, *Phytoplankton, *Spain, *Tidal effects, Asterionella, Chlorophyta, Diatoms, Nitzs-

chia, Population density, Rivers, Salinity, Scenedesmus, Seasonal distribution, Species composition.

Phytoplankton composition and distribution was studied in a small estuary of Cantabria (Spain) from February to December 1985 under different tidal conditions. All of the 239 species identified showed a high degree of tolerance to salinity changes. The volume of the river exerted great control over the selection and abundance of the species. The community consisted of small cells with high growth rates. Species of clearly fluvial influence (Rhoicosphenia curvata, Asterionella formosa, Scenedesmus quadricauda) as well as estuarine species (Skeletonema costatum, Nitzschia closterium, Buddulphia moboliensis) occurred. Tidal condition did not affect the specific composition of the community, but the number of individuals was always greater at low tide. At all times there was a downward longitudinal gradient of abundance from the innermost to the outermost stations. Variations in the volumes of marine and fresh waters throughout the annual cycle determine the structure of the community. (Author's abstract)
W91-06939

WATER INTERCHANGE BETWEEN THE RIA OF VIGO AND THE COASTAL SHELF.
Instituto de Investigaciones Marinas, Vigo (Spain).
R. Prego, F. Fraga, and A. F. Rios.
Scientia Marina, Vol. 54, No. 1, p 95-100, March 1990. 5 fig, 4 tab, 18 ref.

Descriptors: *Coastal plains, *Estuaries, *Saline-freshwater interfaces, *Spain, *Vigo Estuary, *Water currents, *Water exchange, Flow, Mixing, Nutrients, Salinity, Seasonal variation, Upwelling.

The water interchange between the Ria of Vigo and the coastal shelf was studied from the point of view of salinity and of the freshwater contribution from the drainage basin. In winter the results show a typical estuarine circulation, produced by the great quantity of fresh water running into Ria. This factor causes flows of around 2 million kg/s, 2 m/day upward movement of sea water, and a speed of 3 km/day for the estuarine residual current in the outlet of the Ria. In summer these values decrease to about one sixth of the winter values, although there is an increase in the circulation of up to 1 million kg/s, the consequence of upwelling produced by north winds over the shelf. Later the south wind produce the opposite effect, blocking interchange with the shelf. The mixing of water in the Ria is greater in summer, favoring the arrival and recycling of nutrient salts in the area. (Author's abstract)
W91-06940

GROUNDWATER CONTRIBUTION TO THE NUTRIENT BUDGET OF TOMALES BAY, CALIFORNIA.
San Jose State Univ., CA. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W91-06951

INFLUENCE OF TIDAL MARSHES ON UPLAND GROUNDWATER DISCHARGE TO ESTUARIES.
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. W. Harvey, and W. E. Odum.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 217-236, 1990.8 fig, 2 tab, 35 ref. NOAA Grant 1988 VGMSC-UVA-O.

Descriptors: *Estuaries, *Groundwater movement, *Hydraulic gradient, *Tidal marshes, *Wetlands, Chemical properties, Hydraulic conductivity, Hydrogeology, Interstitial water, Model studies, Physical properties, Salinity, Sediments.

The subsurface hydrology in two fringing tidal marshes and in underlying aquifers in the coastal plain of Virginia was investigated. Vertical distributions of hydraulic conductivity, hydraulic head and salinity were measured in each marsh and a nearby subtidal sediment. Discharge of hillslope groundwater into the base of the marshes and subtidal sediment was calculsted using Darcy's Law. In the marshes, fluxes of pore water across the sediment surface were measured or estimated by water balance methods. The vertical distribution of salt in shoreline sediments was modeled to assess transport and mixing conditions at depth. Hydraulic gradients were upward beneath shoreline sediments; indicating that groundwater was passing through marsh and subtidal deposits before reaching the estuary. Calculated discharge was small relative to fluxes of pore water across the marsh surface at those sites; even where discharge was maximal (at the upland border) it was 15 to 50 times less than infiltration into marsh soils. Pore water turnover in the marshes was therefore dominated by exchange with estuarine surface water. In contrast, new interstitial water entering subtidal sediments appeared to be primarily groundwater, discharged from below. The presence of fringing tidal marshes delayed transport and increased mixing of groundwater and solute as it traveled towards the estuaries. Soil-contact times of discharged groundwater were up to 100% longer in marshes than in subtidal shoreline sediments. Measured and modeled salinity profiles indicated that, prior to export to estuaries, the solutes of groundwater, marsh pore water and estuarine surface water were more thoroughly mixed in marsh soils compared to subtidal shoreline sediments. These findings suggest that transport of reactive solutes in groundwater may be strongly influenced by shoreline type. (Author's abstract)
W91-06952

RADIUM IN THE SUWANNEE RIVER AND ESTUARY: SPRING AND RIVER INPUT TO THE GULF OF MEXICO.
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W91-06953

GROUNDWATER SEEPAGE ALONG A BARRIER ISLAND.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2F.
W91-06954

NUTRIENT COUPLINGS BETWEEN ON-SITE SEWAGE DISPOSAL SYSTEMS, GROUNDWATERS, AND NEARSHORE SURFACE WATERS OF THE FLORIDA KEYS.
Harbor Branch Oceanographic Institution, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W91-06956

IN SITU VOLTAMMETRIC MEASUREMENT OF TRACE ELEMENTS IN LAKES AND OCEANS.
Geneva Univ. (Switzerland). Dept. de Chimie Minerale, Analytique et Appliquee.
For primary bibliographic entry see Field 5A.
W91-07016

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALTING PRACTICES IN THE UNITED STATES.
CH2M Hill, Inc., Gainesville, FL.
O. K. Buros.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 38-42, November 1989. 2 fig, 4 tab, 5 ref.

Descriptors: *Desalination, *Desalination apparatus, *Desalination plants, *Potable water, *Water resources development, *Water supply development, Desalination wastes, Distillation, Economic aspects, Electrodialysis, Membranes, Municipal water, Operating costs, Reverse osmosis, Ultrafiltration, Water costs, Water demand, Water softening, Water treatment.

Desalination, or desalting, refers to the removal of salts from water. Currently in the United States, desalination is primarily used to eliminate long distance water transmission, refine industrial processes, and remove specific chemicals. The use of desalination processes to produce municipal potable water in the United States is still limited but is steadily increasing as the need to develop saline waters becomes more urgent. Within the mainland United States, desalting of brackish water and softening of hard water will probably be the key applications for desalination technologies over the next ten years. Both reverse osmosis (RO) and electrodialysis (ED) desalination processes will be used, but it is likely that RO will continue to have the major market share. Along the coastal areas and in the island possessions of the United Sates, seawater desalination will continue to increase, either by RO or distillation, depending on site-specific conditions. The share of the water market using desalination-related technologies will rise as water professionals become more aware of the potential for desalting, as costs for conventional treatment and transmission increase, and as technological advances in desalting reduce costs and improve the products that are available. Over the past forty years, the use of desalination technology to produce water for municipal purposes has developed from an idea to an industry. The next thirty years should take it from the exotic to the commonplace in water treatment. (Korn-PTT)
W91-06808

USE OF MEMBRANE TECHNOLOGY IN FLORIDA.
Florida State Dept. of Environmental Regulation, Tallahassee. Water Supply Section.
G. M. Dykes, and W. J. Conlon.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 43-46, November 1989. 3 tab, 13 ref.

Descriptors: *Desalination, *Desalination apparatus, *Desalination plants, *Electrodialysis, *Filtration, *Florida, *Membranes, *Reverse osmosis, *Water resources development, *Water supply development, Brackish water, Cost analysis, Desalination wastes, Dissolved solids, Economic aspects, Operating costs, Water costs, Water demand, Water quality, Water softening, Water treatment.

Florida water suppliers have been using membrane treatment technology for decades. The use of membranes for brackish water treatment in Florida started with the construction of an electrodialysis (ED) plant. These first membrane systems were used in isolated instances for desalinating limited amounts of seawater; cost were high and the technology was relatively unperfected. Rapid development of coastal areas, with their abundant supplies of brackish water, has led many larger water suppliers to turn to membrane systems to meet increasing demand. Tremendous advances have been made in membrane technology in the last two decades with membranes being tailored to meet specific goals. In Florida, low pressure technology is generally applied to brackish waters with $<3{,}500$ mg total dissolved solids (TDS)/L. Standard pressure reverse osmosis (RO) is used to treat brackish waters with 3500-7000 mg TDS/L, while seawater RO technology would be used for water having >7000 mg TDS/L. Advances in membrane technology, its ability to produce high-quality water, and the flexibility offered by modular expandability have enhanced the cost-effectiveness of RO and electrodialysis as treatment options. Almost 100 FLorida water systems are now using membrane processes to produce a total of nearly 50 mgd, and existing plans call for total production capacity to more than triple. (Author's abstract)
W91-06809

3C. Use Of Water Of Impaired Quality

RESPONSE OF MESQUITE TO NITRATE AND SALINITY IN A SIMULATED PHREATIC ENVIRONMENT: WATER USE, DRY MATTER AND MINERAL NUTRIENT ACCUMULATION.
Oregon Graduate Center, Beaverton. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 2B.
W91-06312

USING WASTE MANAGEMENT PRODUCTS AS AN ALTERNATIVE TO DEPLETING NONRENEWABLE FERTILIZER SOURCES.
Battelle Columbus Div., OH.
For primary bibliographic entry see Field 5E.
W91-06450

SEWAGE SLUDGE APPLICATION TO AGRICULTURAL LAND.
Battelle Memorial Inst., Columbus, OH.
For primary bibliographic entry see Field 5E.
W91-06451

INFLUENCE OF IRRIGATION WITH PULP AND PAPER MILL EFFLUENT ON SOIL CHEMICAL AND MICROBIOLOGICAL PROPERTIES.
Tamil Nadu Agricultural Univ., Coimbatore (India). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5E.
W91-06788

MICROBIAL QUALITY AND PERSISTENCE OF ENTERIC PATHOGENS IN GRAYWATER FROM VARIOUS HOUSEHOLD SOURCES.
University of South Florida, Tampa. Coll. of Public Health.
J. B. Rose, G. S. Sun, C. P. Gerba, and N. A. Sinclair.
Water Research WATRAG, Vol. 25, No. 1, p37-42, January, 1991, 6 fig, 2 tab, 15 ref.

Descriptors: *Water reuse, *Domestic water, *Wash water, *Bacterial analysis, *Bacterial growth, Public health, *Pathogenic bacteria, Coliforms, Viruses.

The microbial and chemical composition of graywater from bath/shower, was cycle and rinse cycle of a clothes washing machine were determined to evaluate the quality and safety of graywater were found to persist for at least several days. Poliovirus type 1 added to graywater decreased 99 and 90% at 25 and 17C, respectively, after 6 d of storage in graywater. These data imply that there may be some risk associated with reuse of graywater when these pathogenic bacteria or viruses are being excreted by an individual producing graywater. (Author's abstract)
W91-06862

SALINITY--AN OLD ENVIRONMENTAL PROBLEM.
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Water Resources.
D. R. Williamson.
Technical Memorandum 90/7, June 1990. 10p, 1 fig, 3 tab, 9 ref.

Descriptors: *Irrigation practices, *Saline water, *Salinity, *Water pollution sources, Agriculture, Clear-cutting, Drainage, Groundwater recharge.

The establishment of irrigated and non-irrigated agriculture has been accompanied by extensive salinization of productive agricultural land, and the progressive degradation of rivers in Australia. This secondary salinity occurs as saline seepages (798000 ha), saline irrigated land (156000 ha), and nonpotable divertible surface water resources (1326 million cu m annually). The volume of groundwater degraded since European settlement is unknown. The trend is for increasing salinization. The cause of the problem is the clearing of native vegetation resulting in the mobilization of salt accumulated over 1000s of years in the soils and aquifers. The primary source is from the ocean via rainfall. The change from deep-rooted perennial plants to shallow-rooted crops and pastures reduces evapotranspiration and interception. The excess water drains beyond the roots of plants to add to the groundwater system, to establish seepage at the soil surface, and discharge into streams. The enhanced salt load to streams is from 4 to 20 times the pre-clearing levels. Salinity is a groundwater problem, governed by the complexities of subsurface water movement. Management strategies focus on eliminating the source of water or modifying the mechanism which mobilizes the salt. Methods include: reduction of excess recharge by irrigation control and vegetation management; artificial drainage; and, enhanced discharge. An integrated whole catchment management approach is essential. While long-term strategies take effect, saltland pasture management has been demonstrated to provide an economic return for otherwise waste land. (Author's abstract)
W91-07049

3D. Conservation In Domestic and Municipal Use

ISLE OF WIGHT WATER METERING TRIAL.
Southern Water Services Ltd., Isle of Wight Division, England.
For primary bibliographic entry see Field 3F.
W91-05966

NETWORK MANAGEMENT--THE BRADFORD EXPERIENCE.
Yorkshire Water Authority (England). Western Div.
For primary bibliographic entry see Field 5F.
W91-05967

3E. Conservation In Industry

PERSPECTIVE OF WATER RESOURCES IN JAPAN AND IN THE WORLD.
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
For primary bibliographic entry see Field 6D.
W91-06040

3F. Conservation In Agriculture

ISLE OF WIGHT WATER METERING TRIAL.
Southern Water Services Ltd., Isle of Wight Division, England.
A. L. Smith, and D. V. Rogers.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 403-409, October 1990. 3 fig, 2 ref.

Descriptors: *England, *Water conservation, *Water metering, *Water resources management, *Water supply, Isle of Wight, Utilities, Water conveyance.

The Isle of Wight water metering trial is one of twelve being conducted in England and Wales. This trial involves installing water meters in all 53,000 Island properties. The trials were designed to test the economics and costs of the introduction of metering over a wide area and to specifically examine meters placed either within a property or laid at the property boundary. The benefits of the two meter locations needed to be assessed, taking into account cost, difficulties of installation, acceptability, leakage, the ease of meter reading by customers and the utility staff, reliability and susceptibility to damage. It was decided that 29,000 meters in one part of the Island would be located externally, and 23,500 internally in the remaining part. The installation program was designed to be completed in 18 months. Problems encountered included installation of internal meters, joint supplies, electrical earthing and long service pipes that extended over several properties. By December 1989 approximately 35,000 meters (65% external) and been installed and 46,000 property surveys had been completed. There has been considerable interest in the trial throughout the Island, and customer reaction has generally suggested that water metering is accepted as being a fairer method of payment for water. Customers have been acutely aware of the slightest amount of leakage, and this has inevitably led to a reduction of waste on the Island. (Feder-PTT)
W91-05966

EFFECT OF WETTING AND DRYING ON THE SOIL STRUCTURE.
Moscow State Univ. (USSR). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W91-05979

EFFECT OF THE COMPOSITION OF SOIL SOLUTIONS AND EXCHANGE CATIONS ON WATER RETENTION AND HYDRAULIC CONDUCTIVITY.
Institute of Applied Physics, Pushkino (USSR).
For primary bibliographic entry see Field 2G.
W91-05980

STRATEGIES FOR SUSTAINABLE AGRICULTURE IN THE TROPICS.
Florida Univ., Gainesville. Dept. of Geography.
N. J. H. Smith.
Ecological Economics, Vol. 2, No. 4, p 311-323, 1990. 58 ref.

Descriptors: *Agricultural practices, *Agricultural water, *Conservation, *Erosion control, *Resources development, *Tropical regions, Crop production, Crop yield, Developing countries, Irrigation water, Livestock, Natural resources, Policy making, Reviews, Technology, Urbanization, Water resources management.

Sustainable agriculture has moved to the forefront of priorities within the global agricultural research system. Strategies for sustaining yield gains include the conservation and evaluation of plant and animal genetic resources, integrated pest management, conservation and enlightened management of soil and water resources, and crop and livestock diversification. Progress in these areas is reviewed. It is concluded that the productivity of existing farmlands needs to be improved and stabilized if there is to be any hope of feeding the world's growing population. This will require high levels of inputs, which can involve purchased items, or can rely primarily on organic supplements and manual labor. Water and soil management are often intertivined. To help check soil erosion, slopes are sometimes planted with trees. A wooded catchment area provides a more reliable and manageable supply of water for irrigation. The growth of cities with their increased demand for water is threatening the availability of irrigation water in some regions. More efficient use of both irrigation and urban water supplies are needed to help sustain agricultural productivity. A combination of traditional conservation strategies and modern technologies, including biotechnologies, is needed. (Doria-PTT)
W91-06108

LOW-RESOURCE AGRICULTURE ALTERNATIVES IN SUB-SAHARAN AFRICA.
Ohio State Univ., Columbus. Dept. of Agronomy.
R. Lal.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 4, p 437-445, July/August 1990. 1 fig, 4 tab, 69 ref.

Descriptors: *Africa, *Agricultural practices, *Agricultural water, *Developing countries, *Irrigation practices, *Public policy, *Resources management, *Tropical regions, *Water conservation, Agricultural chemicals, Crop production, Crop yield, Economic aspects, Erosion control, Fertilizers, Research priorities, Soil management, Technology transfer, Tillage, Water management.

The key to intensifying agriculture and improving food production in tropical Africa is in the management of soil and water resources. Some useful and yield-increasing technologies are available and are now awaiting validation and eventual transfer to various agroecological regions. Soil and water management techniques are known for better soil and water management and erosion control with appropriate tillage and soil surface management. Soil fertility can be improved by growing planted fallows, adopting agroforestry measures, using animal wastes, and applying supplementary fertilizer. Research and development priorities should be given to small-scale irrigation and to soil and water management techniques that involve maximum use of rainwater for crops. In contrast to traditional farming techniques, which have low productivity, improved systems must have high productivity, along with high stability and low risk. Varieties and cropping systems must be tolerant to pests and be able to maintain economic yields at low levels of soil fertility. Soil management systems must minimize dependence on agrichemicals and preserve the natural resources. Resource-efficient technologies must be promoted by adequate incentives through judicious pricing policies and by providing storage and marketing facilities. (Doria-PTT)
W91-06114

IMPROVING IRRIGATION SCHEDULES TO INCREASE RETURNS AND REDUCE WATER USE IN HUMID REGIONS.
Virginia Polytechnic Inst., Blacksburg. Dept. of Agricultural Engineering.
D. J. Bosch, and B. B. Ross.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 4, p 486-489, July/August 1990. 3 tab, 13 ref.

Descriptors: *Agricultural water, *Crop yield, *Economic aspects, *Humid climates, *Irrigation efficiency, *Irrigation practices, *Irrigation water, *Water conservation, Computer programs, Conservation, Corn, Costs, Evapotranspiration, Leaching, Model studies, Monetary returns, Monitoring, Prices, Profit, Runoff, Soil erosion, Soil water, Soil-water-plant relationships, Sprinkler irrigation, Transpiration, Water use.

Careful choice of irrigation application rate and timing, particularly in humid regions, can help irrigators maintain yields with less water. Computer simulations were used to compare strategies that vary according to when irrigation is initiated, rate of application, and how much information is used to help make the irrigation decision. Basing scheduling decisions on better information lowered average per-acre water applications from 11.7 inches to 5.5 inches, a reduction of more than 50% compared to the benchmark irrigation strategy. Better scheduling also increased average per-acre net returns from $20.44 to $31.88, an increase of more than 50% compared to the benchmark. These savings were achieved largely by reducing water use and, consequently, labor and energy costs. By substituting information and management time for water, the irrigator can raise returns while conserving water and energy. Less water is applied, so the potential for soil erosion and leaching and runoff of nutrients and pesticides should be reduced. These results should be representative of many humid areas where irrigation supplements rainfall; rainfall and crop water demand are uncertain; irrigated soils have low water-holding capacities; and water is applied with sprinkler irrigation systems that are more labor-intensive and energy-intensive. (Doria-PTT)
W91-06118

LAND-LEVELING EFFECTS ON SOIL TEXTURE, ORGANIC MATTER CONTENT, AND AGGREGATE STABILITY.
Agricultural Research Service, Bushland, TX. Conservation and Production Research Lab.
P. W. Unger, L. J. Fulton, and O. R. Jones.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 3, p 412-415, May/June 1990. 1 tab, 18 ref.

Descriptors: *Agricultural practices, *Land leveling, *Land management, *Soil properties, *Water conservation, Clays, Sand, Silt, Soil aggregates, Soil analysis, Soil organic matter, Soil texture.

Land leveling improves water conservation on dryland. However, leveling shifts the depth to soil horizons relative to the original soil surface and thus may cause unfavorable surface conditions after leveling, depending on the nature of the subsurface horizons. Soil conditions on leveled and adjacent non-leveled plots were evaluated. Leveling slightly but significantly affected soil sand, silt, clay, and organic matter contents and aggregate stability. Land leveling is recommended for improving crop productivity on dryland soils, such as Pullman clay loam. The leveling should be limited to narrow strips so that the maximum depth of cut is 10 cm (4 inches) or less. (Author's abstract)
W91-06276

DROUGHT-INDUCED ACCUMULATION OF NITRATE IN GRAIN SORGHUM.
Arkansas Univ., Hope. Southwest Research and Extension Center.
For primary bibliographic entry see Field 2G.
W91-06300

EVALUATING WATER SUPPLY OUTLOOK FOR FERTILIZING HAY UNDER VARIABLE STREAMFLOWS.
Wyoming Univ., Laramie. Dept. of Agricultural Economics.
L. J. Held, and J. J. Jacobs.
Journal of Production Agriculture, Vol. 3, No. 4, p 429-435, 1990. 7 tab, 14 ref.

Descriptors: *Farm management, *Irrigation efficiency, *Streamflow forecasting, *Water use efficiency, *Wyoming, Crop production, Economic evaluation, Fertilization, Hay, Meadows, Mountain streams.

A major portion of annual streamflow in mountain and intermountain regions of the West comes from mountain snowpack, which can be variable from year to year. For irrigators relying on direct streamflows, the consequences of variable water supplies can be quite adverse. Annual streamflow forecasts (issued cooperatively by the Soil Conservation Service and National Weather Service) were evaluated for adapting fertilizer use to expected streamflow when producing mountain meadow hay in the upper Wind River area of Wyoming. Streamflow forecasts are found to be 90% effective for predicting above or below average streamflow over the 6-month (April-September) period from February forecasts. Applying N fertilizer in response to forecasted water supplies in an example mountain hay meadow yields additional net revenue of at least $7.94/acre compared to fixed, nonadaptive strategies of regularly fertilizing either all, 50%, or none of the affected meadow acreage. In addition, streamflow forecasts appear to provide risk-averse producers a viable basis for increasing hay production with N fertilizer, given conditions of variable water supplies. (Author's abstract)
W91-06301

SOIL TYPE, PRECIPITATION, AND FERTILIZER N EFFECTS ON CORN YIELDS.
Wisconsin Univ.-Stevens Point. Coll. of Natural Resources.
S. L. Oberle, and D. R. Keeney.
Journal of Production Agriculture, Vol. 3, No. 4, p 522-527, 1990. 2 fig, 5 tab, 32 ref.

Descriptors: *Corn, *Crop yield, *Fertilizers, *Nitrogen, *Soil-water-plant relationships, *Water pollution sources, Agricultural hydrology, Farm management, Fertilization, Leaching, Nitrates, Precipitation, Regression analysis, Soil physical properties, Soil types, Soil water, Wisconsin.

An understanding of the most important factors affecting corn yields and yield response to N fertilizer is required to provide effective N management recommendations over a wide range of soil-climate conditions and to assess the potential for the leaching of NO3 to groundwater. A study was performed using multiple regression techniques to examine the relationships among soil type, precipitation, fertilizer N rate, and corn grain yields from numerous continuous corn plot studies in Wisconsin. Nitrogen fertilizer rates required to maximize yields were lower on rainfed silt loam and silty clay loam soils (155 to 210 lb N/acre) than on irrigated loamy sand or sandy loam soils (175 to 230 lb N/acre). Similarly, economic optimal N rates were considerably lower on silt loam and silty clay loam soils than on irrigated sandy soils, especially at low N:corn price ratios. Linear and quadratic fertilizer rate variables explained only 10 to 38% of the variation in grain yields on silt loam or silty clay loam soils, whereas more than 65% of the variation was explained on irrigated sandy soils. As would be expected, pre-season and early-season precipitation were important factors with the rainfed soils. Other key variables included available N contributions from soil organic matter and residual profile NO3. Although not measured directly, soil physical properties (soil depth, water holding capacity) also probably contributed to yield variations on rainfed silt loam and silty clay loam soils. Importantly, it was demonstrated that economic optimal N rates would often be considerably less than N fertilizer rates required to attain maximum yield. Also, grouping of soil types with similar organic matter contents, rooting depths, and drainage characteristics for N management recommendations is feasible. (Fish-PTT)
W91-06302

PREPLANT TILLAGE EFFECTS ON IRRIGATED CORN GROWN ON A SANDY SOIL.
Agricultural Research Service, Prosser, WA.
D. E. Miller, and J. S. Aarstad.
Journal of Production Agriculture, Vol. 3, No. 4, p 606-609, 1990. 5 tab, 13 ref.

Descriptors: *Corn, *Crop yield, *Erosion control, *Farm management, *Soil management, *Tillage, Crop production, Grain crops, Grasses, Herbicides, Sand, Soil erosion, Soil surfaces.

Sandy soils are extremely vulnerable to wind erosion when bare. Crop residue on the soil surface is an effective control. Crop responses to tillage systems that leave crop residue on the soil surface may differ from clean tillage of sandy soils. A 4-year study on a sandy soil compared moldboard plowing (MP) with two residue conserving tillage systems, no preplant tillage (NPT) and Paraplow (PP), on field corn (Zea mays L.) production. Corn silage yields were similar (about 34 ton/acre) with all three tillage systems. Averaged over the 4 years, grain yields were significantly affected by tillage in the order PP>MP>NPT with yields of 5.9, 5.6, and 5.2 ton/acre, respectively. Where herbicides had not been applied, large crabgrass (Digitaria sanguinalis (L.) Scop.) populations in MP were 11.1 plants/sq ft compared with 1.6 with PP and 2.6 with NPT. Grain yields on the moldboard plowed plots were about 0.5 ton/acre higher with than without herbicides. These results indicate that tillage systems that leave plant residue on the surface may be used on sandy soils without serious loss of production, especially if the subsoil is loosened. (Author's abstract)
W91-06303

WILDLIFE AND FISH AND SUSTAINABLE AGRICULTURE.
Izaak Walton League of America, Decorah, IA.
For primary bibliographic entry see Field 5G.
W91-06306

COMBINED EFFECTS OF LEACHING FRACTION, SALINITY, AND POTASSIUM CONTENT OF WATERS ON GROWTH AND WATER-USE EFFICIENCY OF WHEAT AND BARLEY.
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Soil Science.
M. S. Heakal, A. S. Modaihsh, A. S. Mashhady, and A. I. Metwally.
Plant and Soil PLSOA2, Vol. 125, No. 2, p 177-184, 1990. 3 fig, 4 tab, 9 ref.

Descriptors: *Irrigation practices, *Plant growth, *Saline water, *Salt stress, *Salt tolerance, *Soil-water-plant relationships, *Water use efficiency, Barley, Calcium, Crop yield, Dry matter, Electrical conductivity, Evapotranspiration, Grain crops, Leaching, Phosphorus, Potassium, Saline soils, Wheat.

A clear and comprehensive understanding of the deleterious effects of salinity on plant growth has been lacking. A better knowledge of the interactive effects of potassium and calcium in substrates on salt-stressed plants may contribute to better agrotechniques for irrigated agriculture. Wheat and barley seedlings growing in pots in a greenhouse, with a non-saline sandy loam soil were irrigated by saline waters, S1, S2, and S3, having electrical conductivity (EC) = 3, 9, and 15 mS/cm, respectively. Each solution has three potassium concentrations, K1 = 6, K2 = 11, and K3 = 16 meq/L, and all incorporated N (90 mg/L) and micronutrients. Irrigation was provided to realize 0.2 and 0.5 leaching fractions (L). At maturity, dry matter of plant tops (Y), grain yield (G), and evapotranspiration (ET) of both crops responded significantly to the S, L, and K treatments. There were different interactions, however, between the crops indicating some effect of plant species. In both, a decrease in Y with increasing salinity was associated with a corresponding decrease in ET. In the most saline S3 treatments, where the available water to plants was the lowest, an ample K supply produced substantial improvements in salinity tolerance of both crops. Under these conditions, changes in Y and ET were independent of each other. Increasing K supply, reduced the rate by which Y decreased with respect to S. Barley accumulated dry matter more efficiently (in terms of ET/Y, g per g) particularly under L = 0.2. This efficiency for both crops did not respond to the water salinity but rather to the potassium concentration of the waters. The whole experiment was also carried out under two levels of phosphorus application (35 and 70 mg P/kg soil). Neither growth nor water-use efficiency were significantly affected by the higher rate of phosphorus application. (Fish-PTT)
W91-06311

DEVICE FOR AUTOMATIC SOIL MOISTURE CONTROL AND REGISTRATION OF WATER USE IN POT EXPERIMENTS.
Instituut voor Oecologisch Onderzoek, Heteren (Netherlands).
F. C. Zoon, F. J. Hage, and A. De Zwart.
Plant and Soil PLSOA2, Vol. 125, No. 2, p 281-284, 1990. 2 fig, 8 ref.

Descriptors: *Automation, *Instrumentation, *Irrigation efficiency, *Irrigation management, *Measuring instruments, *Soil water, *Soil-water-plant relationships, Computer programs, Evapotranspiration, Experimental data, Laboratory equipment.

Soil moisture regimes experienced by plants in pot experiments are often quite different from those in the field, because of physical differences, evapotranspiration stress, and large fluctuations of soil moisture content. A computer-regulated watering device is able to conduct frequent watering and recording of water use, thus saving much repetitive work. An apparatus has been constructed for automatic replenishment of water lost by evapotranspiration in pot experiments. The system can handle 80 pots. The upper and lower weight limit for each pot, and the weighing frequency can be set. In this way, constant soil moisture levels as well as fluctuations can be arranged. The apparatus can be programmed for continuous cycling, thus minimizing position effects within an experiment. Cumulative daily water use per pot or transpiration per plant is recorded on tape and printed. Special applications may include controlled nutrient dosage and determination of transpiration coefficients. (Author's abstract)
W91-06313

SOIL PHYSICAL BEHAVIOUR AND CROP RESPONSES TO TILLAGE IN LOWLAND RICE SOILS OF VARYING CLAY CONTENT.
International Rice Research Inst., Los Banos, Laguna (Philippines).
B. Mambani, S. K. De Datta, and C. A. Redulla.
Plant and Soil PLSOA2, Vol. 126, No. 2, p 227-235, 1990. 6 fig, 3 tab, 13 ref.

Descriptors: *Agricultural hydrology, *Clays, *Crop yield, *Rice, *Soil moisture retention, *Soil types, *Soil-water-plant relationships, *Tillage, Clay loam, Grain crops, Greenhouses, No-till cultivation, Philippines, Roots, Soil water, Water stress, Wetlands.

Lowland rice responds to tillage according to soil type and hydrological balance. Studies integrating soil factors and conditions modifying their effects on crops are therefore needed. The influence of various tillage methods on two wetland rice soils in the Philippines was studied. The soils differed principally in clay content 38% for the clay loam and 56% for the clay). This had a marked effect on their response to tillage and varying water regime. The clay soil, under field conditions, showed little change in pore size distribution or soil water behavior with different tillage methods. Rice crop yields were unaffected by tillage. In contrast, tillage effects were very marked in the clay loam soil, which consisted of a greenhouse and a field trial. In the greenhouse, which experienced severe dry periods, wet tillage not only increased the moisture retentivity but also the soil impedance at soil matric potential < -0.01 MPa. Seasonal average soil matric potential was < -1 MPa. Root length density decreased by 39% with dry tillage and by 56% with wet tillage compared with zero tillage. Grain yield, however, did not vary with soil treatment. In the field, which experienced moderate dry spells, soil matric potential varied between -0.13 and -0.48 MPa. Root length density was significantly reduced at soil impedance >0.75 MPa. Wet tillage increased soil moisture storage which minimized the soil impedance during the dry cycle more effectively than did dry tillage. The crop performed best under moderate than under severe water stress conditions. (Fish-PTT)
W91-06315

RICE HULL AND CARYOPSIS DISCOLORATION DISEASES: I. SEVERITY AND INCIDENCE IN THREE ECOSYSTEMS IN WEST AFRICA.
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2I.
W91-06318

RICE HULL AND CARYOPSIS DISCOLORATION DISEASES: II. EFFECTS OF SOIL AND SOIL WATER ON HULL DISEASE AT TWO SITES IN NIGERIA.
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2I.
W91-06319

NUTRIENT NEEDS.
Georgia Tech Research Corp., Atlanta.
S. Babbitt.
Agricultural Engineering AGENAZ, Vol. 72, No. 1, p 8-9, January 1991. 2 fig.

Descriptors: *Agricultural engineering, *Ammonia, *Fertilization, *Nutrient requirements, *Nutrients, *Sensors, *Water pollution control, Georgia, Groundwater pollution, Nitrogen compounds, Soil chemistry.

Providing nutrients to crops on an as-needed basis using more efficient application techniques would be more economical for the farmer and would contribute less to ground and surface water pollution. Researchers in Georgia are investigating the development and application of an ammonia sensor to detect gaseous ammonia, as it is generated, in concentrations as low as 10 parts per billion. This project is targeting two final field applications: improving efficiency in the application of anhydrous ammonia and optimizing the use of all nitrogen-based fertilizers. Ammonia emissions are indicators of soil chemistry as it relates to fertilizer management techniques; monitoring ammonia emissions can provide researchers with important information on changes in fertilizer management and eventually could help determine real-time crop nitrogen requirements. Use of an ammonia sensor would also indicate the release of excess ammonia due to improperly-adjusted pumps and injectors, and unsuitable soil conditions. The sensor being developed is based on an integrated optic (IO) design that incorporates a planar waveguide structure rather than the more familiar cylindrical optical fiber configuration. The integrated design is more durable and can be mass produced at a lower cost. An IO multimode device is capable of highly sensitive differential absorption and differential interferometric measurements, by using the interaction of a guided light beam with a cover medium surrounding a portion of the waveguide. As the sensors are developed, they will be subjected to a series of environmental tests to determine response characteristics and range of operation. (Fish-PTT)
W91-06398

RAINFALL DISTRIBUTION UNDER A CORN CANOPY: IMPLICATIONS FOR MANAGING AGROCHEMICALS.
National Soil Tilth Lab., Ames, IA.
T. B. Parkin, and E. E. Codling.
Agronomy Journal AGJOAT, Vol. 82, No. 6, p 1166-1169, November/December 1990. 1 fig, 4 tab, 10 ref.

Descriptors: *Agricultural engineering, *Farm management, *Rainfall distribution, *Rainfall-runoff relationships, *Soil-water-plant relationships, *Stemflow, Agricultural chemicals, Canopy, Corn, Furrows, Leaching, Path of pollutants, Soil water, Spatial distribution.

A greater understanding of the spatial patterns of water inputs to soil will aid the development of agricultural practices to reduce leaching and runoff of agrochemicals. A study was initiated to investigate the process of stemflow, and to provide quantitative data on the distribution of rainfall under a corn canopy. Rainfall distribution under the canopies of replicate conventional till corn plots was investigated by placing rainfall collectors at discrete locations within small 1.6-m by 0.76-m areas of the plots. Collection cups were also fixed around the stalks of individual corn plants to quantify stemflow. Results obtained from eight storm events in 1987 revealed that corn plants channel 19 to 49% of the total rain inputs down the stem to the base of the stalk. This stemflow plus the rainfall impinging directly in the planting furrow, accounted for approximately 42% of the total water inputs from a given storm event. These increased water inputs to the planting furrow may have implications in modeling solute leaching and runoff as well as to modifying current fertilizer and pesticide application methods. (Author's abstract)
W91-06401

ENERGY, WATER, AND ECONOMIC SAVINGS OF IMPROVED PRODUCTION SYSTEMS ON THE TEXAS HIGH PLAINS.
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
S. M. Masud, and R. D. Lacewell.
American Journal of Alternative Agriculture, Vol. 5, No. 2, p 69-75, 1990. 6 tab, 28 ref.

Descriptors: *Crop production, *Economic evaluation, *Energy, *Irrigation efficiency, *Texas, *Tillage, Benefits, Corn, Cost-benefit analysis, Cotton, Electric power demand, Farm management, Fuel, Irrigation programs, Natural gas, Sorghum, Soybeans, Water use, Wheat.

An attempt has been made to quantify economic and energy use implications of new improved irrigation and limited tillage production systems for the Texas High Plains. Per hectare uses of natural gas and electricity under alternative irrigation distribution systems for corn, sorghum, wheat, cotton, and soybeans were utilized to estimate total amounts of natural gas and electricity used in the production of these crops on the High Plains of Texas. The amount of diesel fuel used was estimated for conventional and limited tillage systems

under dryland and irrigation production. Total amounts of water used for the five crops under the improved and conventional irrigation systems were also estimated for the High Plains. Results indicated improved irrigation and limited tillage systems reduced energy and water use on the High Plains. Total natural gas and electricity were estimated to decline over 20%, diesel fuel declined 32%, and water use for irrigation declined about 23%. Use of the improved irrigation and limited tillage production systems was also shown to significantly increase annual net returns to farmers ($40.0 million or 13.3%). (Author's abstract)
W91-06402

REDUCE GREENHOUSE RUNOFF.
Ohio Agricultural Research and Development Center, Wooster.
W. L. Bauerle.
American Vegetable Grower AMVGA5, Vol. 38, No. 12, p 44-47, December 1990. 1 fig.

Descriptors: *Agricultural engineering, *Greenhouses, *Irrigation efficiency, *Nutrients, *Recirculated water, Agricultural runoff, Automation, Fertilization, Groundwater pollution, Plant growth, Water use efficiency.

Greenhouse growers are facing increasing pressure to adopt growing practices that will keep groundwater free from pesticide and fertilizer runoff. There are steps most growers can take to reduce runoff, such as reducing water usage; use of low-pressure, low-volume drip emitters and pans or saucers under pots; and automatic systems. With automatic systems, various methods are used to initiate the irrigation cycle, including a time clock, solar radiation, diffusion pressure deficit, start tray, or computer activation. As recirculating systems become more economical, more growers will want to use this technology to save water, fertilizer, and labor. Much of the success in recirculating systems can be attributed to an integrated approach of fertilizer programs, environment and water management, and biological control. The end result is the prescription growing of plants controlling parameters such as height, leaf size, number and size of flowers, and postharvest quality. The nutrient uptake by the plant is an active process with an adequate range for each nutrient. All that is required in recirculating water systems is to match or tailor precisely the inorganic nutrient input with the metabolic process of the species being grown. The amount of fertilizer used in a recirculating system as compared with the amount used in an open-drain system is at least nine times less, and the effluent is recycled rather than released to contaminate groundwater. Attention must be paid to: maintaining a proper nutrient balance, the processing equipment used to recirculate the water, maintaining the pH levels at 5.6 to 5.8, and good sanitation practices for disease prevention. (Fish-PTT)
W91-06403

IRRIGATION SUITABILITY OF SOLONETZIC SOILS IN THE COUNTY OF NEWELL, ALBERTA.
Alberta Agriculture, Lethbridge. Land Evaluation and Reclamation Branch.
D. R. Bennett, and T. Entz.
Canadian Journal of Soil Science CJSSAR, Vol. 70, No. 4, p 705-715, November 1990. 2 fig, 5 tab, 21 ref.

Descriptors: *Alberta, *Farm management, *Irrigation effects, *Land classification, *Soil properties, *Soil science, Agricultural hydrology, Alkaline soils, Canada, Crop production, Irrigation practices, Land use, Saline soils, Soil chemistry, Water table fluctuations.

In Alberta, Canada, land classification for irrigation consists of an assessment of the general capability of land for irrigated use and is based on the nature and degree of limitations imposed by the characteristics of a given land unit. A five-year study was conducted in the County of Newell to monitor soil salinity and sodicity, water table levels and crop production on Solonetzic soil associations under normal irrigation practices. All soil associations consisted of at least 50% Solonetzic Order soils, with Brown Solod as the dominant subgroup at all but one site. Changes in soil quality were monitored through regular measurements of water table levels, annual fall sampling and chemical analysis of soils. Irrigation practices used by farmers did not permanently raise water table levels at any of the sites irrigated by center pivots. Changes in soil salinity or sodicity as a result of irrigation were generally not statistically significant, suggesting that the salt status of soils at most sites did not change appreciably over the five-year period. The relatively low productive capability of land units dominated by Solonetzic soils was evident in the low yield and by a high degree of variability in yield within individual sites. Careful irrigation management partially compensated for some of the soil limitations in these Solonetzic soil landscapes; however, due to the low productivity observed, modification of existing land classification standards to allow irrigation of Solonetzic soils is not presently recommended. (Author's abstract)
W91-06409

NITROGEN LEACHING FROM CYPRESS WOOD CHIPS.
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
E. F. Gillman, T. H. Yeager, and D. Weigle.
Horticultural Science, Vol. 25, No. 11, p 1388-1391, November 1990. 3 fig, 1 tab, 6 ref.

Descriptors: *Fertilization, *Horticulture, *Leaching, *Mulches, *Nitrogen compounds, Landscaping, Nitrification, Soil surfaces, Soil water.

Cypress-mulched landscape plants are commonly fertilized by spraying the entire surface of the mulch. However, the influence of the cypress mulch on leaching of nitrogen (N) is unknown. To study this effect, columns (4 x 15 cm) of incubated (25 C, 7% volumetric moisture) milled cypress (Taxodium distichum (L.) L. Rich) wood chips received 180 mg of each ionic form of N applied to the surface from dry NH4NO3, KNO3, or (NH4)2SO4 and were leached daily with 16 ml deionized water (pH 5.5). After 10 days, >85% of applied N leached from the columns in all treatments. After 25 days, all N leached from the NH4NO3 and KNO3 treatments, and 93% leached from the (NH4)2SO4 treatment. In subsequent experiments, columns received 360 mg N from NH4NO3 and were leached daily with either 16, 32, 48, or 64 ml of deionized water for 50 days. The rate of N leaching increased with increasing water application rate, although total N leached per column was similar for all water rates after 25 days. Columns that received 45, 90, 180, or 360 mg N/column were leached daily with 16 ml of deionized water. Nitrogen concentrations in the leachate ranged from 3406 ppm NO3(-)-N and 2965 ppm NH4(+)-N at day 5 for the 360-mg rate to 3 and 5 ppm, respectively, at day 35 for the 45-mg rate. In all experiments with NH4NO3, more NO3(-)-N leached than NH4(+)-N and more NO3(-)-N leached than applied, indicating that nitrification occurred. NH4(+)-N and NO3(-)-N broadcast over cypress wood chips in the landscape would leach quickly into the soil. (Author's abstract)
W91-06414

EFFICIENCY OF NITROGEN USE BY DRYLAND WHEAT IN A SUBHUMID REGION IN RELATION TO OPTIMIZING THE AMOUNT OF AVAILABLE WATER.
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
D. K. Benbi.
Journal of Agricultural Science JASIAB, Vol. 115, No. 1, p 7-10, 1990. 4 fig, 3 tab, 8 ref.

Descriptors: *Agricultural engineering, *Fertilization, *Nitrogen, *Soil-water-plant relationships, *Water use efficiency, Application rates, Fertilizers, India, Soil water, Water supply, Wheat.

It is well known that water and fertilizer nitrogen (N) interact: one substitutes for the other to a certain extent. Under dryland conditions, N application is known to increase water use efficiency and vice versa. But there is an optimum rate of water supply or N application, beyond which increases in one may not bring about an increase in the use of the other. Where water supply is a constraint, identification of the rate of supply is important for water and N management. The effect of soil water supply on efficiency of N use in wheat and NO3-N accumulation in the soil profile was studied in a field experiment on loamy sand soil at Boothgarh in Hoshiarpur, Punjab, India, in 1980/81. It was found that, as the water supply increased from 509 to 548 mm, the response to N application increased by 11.5 kg grain/kg N and apparent N recovery increased by 11% at optimum N application rates. The increase in N recovery with additional water supply was related to the NO3-N use from the profile. The accumulation of NO3-N in the profile was related linearly to rate of N application but inversely to water supply up to an optimum value of 580 mm. Further increase in water supply did not increase fertilizer use. If both the amount of moisture stored in the profile at sowing and the probable rainfall during the crop season are known, the efficiency of fertilizer N use can be predicted. (Fish-PTT)
W91-06417

SIMPLE WATER-BALANCE MODELS FOR SIMULATING MOISTURE, SALINITY AND SODICITY PROFILES IN SOILS UNDER WHEAT.
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
R. Pal, A. K. Kapoor, S. R. Poonia, and M. Raj.
Journal of Agricultural Science JASIAB, Vol. 115, No. 2, p 163-172, 1990. 6 fig, 4 tab, 9 ref.

Descriptors: *Evapotranspiration, *India, *Irrigation practices, *Model studies, *Saline soils, *Soil water, *Soil-water-plant relationships, *Wheat, Electrical conductivity, Farm management, Hydrologic budget, Salts, Simulation analysis, Sodium, Solute transport.

Computer simulation models involving important properties of soil, quality of irrigation water, crop, and climate are useful in assessing the leaching and accumulation of salts, a key to the efficient management of irrigated soils. Experiments were conducted in wheat planted in microplots at Hisar and Sirsa in Haryana state, India, to observe and simulate the depth distribution of moisture content, electrical conductivity in 1:2 soil-water extract (EC 1:2), and exchangeable sodium percentage (ESP) of soils after irrigation with water of high electrical conductivity (12-19 dS/m) and sodium adsorption ratio (20-80 (mmol/l) to the 1/2 power). The three simulation models used differed in the procedure of estimation of evapotranspiration: Model I was a simple water balance model; Model II was similar to the first model, but modified to account for the high evaporative atmospheric demand at the experimental sites; Model III coupled these models with a simple solute transport model. In general, the means of the experimental moisture content profiles decreased and those of EC 1:2 and ESP increased with irrigation at both locations. Statistical analysis showed an overall good agreement between the experimental and simulated values of moisture content, EC 1:2, and ESP; the accuracy of simulation of the models followed the order Model II = Model III > Model I for moisture content and EC 1:2, but was identical for ESP. To increase the scope of such models for practical application as management guides, they need to be further validated on a long-term basis under different irrigation practices and crop rotations. (Fish-PTT)
W91-06418

WATER USE AND AVERAGE GROWTH INDEX OF FIVE SPECIES OF CONTAINER GROWN WOODY LANDSCAPE PLANTS.
Agricultural Research and Education Center, Monticello, FL.
G. W. Knox.
Journal of Environmental Horticulture JEHOD5, Vol. 7, No. 4, p 136-139, 1989. 5 fig, 3 tab, 12 ref.

Descriptors: *Horticulture, *Irrigation efficiency, *Plant water potential, *Water use efficiency,

Florida, Growth media, Irrigation practices, Landscaping, Plant growth, Porous media, Water consumption.

Water conservation and management in nurseries is becoming an important issue as water supplies become limited or restricted due to drought or competition for water with urban areas. Water use efficiency in nurseries could be improved by grouping plants with similar water requirements and by scheduling irrigation based on plant needs. Until recently, little interest was expressed in water use of container-grown landscape plants. The necessity of adequate drainage after heavy rains has resulted in a production system that encourages excess irrigation: plants grown in porous, well-drained media are very tolerant of overwatering, but unforgiving when irrigation is neglected. A study was conducted to record luxury water use throughout one year of a simulated production cycle of five species of container-grown landscape plants commonly produced in north and central Florida. Liners of Juniperus horizontalis Moench 'Wiltonii', Ilex crenata Thunb. 'Rotundifolia,' Rhododendron x L. 'Hershey's Red,' Pyracantha x M.J. Roem 'Teton,' and Photinia x fraseri Dress were grown to saleable size in 3.1 L (1 gal) containers. Plant water consumption was measured during 336 days from June 24, 1986, to June 19, 1987. Pyracantha consumed the most water (50.4 L (13.3 gal)/plant) while the photinia consumed the least water (37.8 L (10.0 gal)/plant). Based on the increase in growth index per liter of water consumed, photinia used water most efficiently. Growth index, pan evaporation, or growth index and pan evaporation were the best predictors of plant water use. (Fish-PTT)
W91-06420

NITROGEN MANAGEMENT AND GROUND WATER PROTECTION.
Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. 395p. Edited by R. F. Follett.

Descriptors: *Agricultural practices, *Groundwater pollution, *Groundwater quality, *Nitrogen cycle, *Nonpoint pollution sources, *Path of pollutants, *Water pollution sources, Aquifers, Cropping, Fertilizers, Groundwater chemistry, Leaching, Nitrates, Nitrogen, Soil management.

The N cycle in soil is an integral part of the overall cycle of N in nature. Under natural conditions, gains in soil N occur through N fixation and from the return of ammonia and nitrate in precipitation. Nitrogen losses occur through crop removal, leaching, gaseous losses, and by transport during soil erosion and surface water runoff. Adequate amounts of plant available N in soil are vital to ensuring the production of sufficient food for the world's population. To enhance its availability for crop growth, N is added to the soil in which crops are grown. Sources of N for addition to soil include fertilizer, crop residue, manure and various other waste materials, and biological N fixation. Once N from any of these sources, including from natural sources, enters the soil it is subject to the chemical transformations that occur in the N cycle in the soil (i.e. immobilization, mineralization, nitrification, and denitrification). If cultural practices, including excessive additions of N to soils, result in the leaching of nitrate by water percolating through the soil profile, then a situation may be set up that results in the leaching of nitrate by water percolating through the soil profile. Thus, in assuring availability of N to plants for crop production, it is becoming increasingly apparent that a higher level of management will be necessary to prevent or minimize the contamination of groundwater and surface water supplies. The authors of chapters in this volume have undertaken the task of placing in perspective the overall problem of the management of nitrogen in producing food while also minimizing impacts to groundwater quality. Chapter titles are: 'ground water quality concerns about nitrogen'; 'sources of nitrate to ground water'; 'nitrate in ground water in the United States'; 'ground water nitrate in other developed countries (Europe)--relationships to land use patterns'; 'nitrate transport and leaching mechanisms'; 'proper accounting for N in cropping systems'; 'fertilizer nitrogen management'; 'estimation of N budgets for crops'; 'impact of soil management practices on N leaching'; 'cropping systems--ecology and management'; 'management of water balance components'; 'linkages with ground water'; and 'transformations and movement of nitrate in aquifer systems'. (See W91-06732 thru W91-06744) (Lantz--PTT)
W91-06731

PROPER ACCOUNTING FOR N IN CROPPING SYSTEMS.
Agricultural Research Service, Lincoln, NE.
J. F. Power, and F. E. Broadbent.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 159-181, 6 tab, 69 ref.

Descriptors: *Cropping, *Groundwater pollution, *Nitrogen cycle, *Nonpoint pollution sources, *Path of pollutants, *Water pollution control, Agricultural practices, Fate of pollutants, Fertilizers, Groundwater quality, Model studies, Nitrogen compounds, Nutrient requirements.

Almost all variables involved in a system of soil and crop management can influence N cycling and the accounting of N in the ecosystem. Consequently, research related to the effects of agriculture upon nitrate accumulation in groundwater must address all aspects of both the N cycle and the hydrological cycle. Dominant in any accounting of N is the yield goal for the production enterprise. This establishes a minimum value for the total N required by the crop, but crop N requirements must be adjusted for efficiency of N uptake, climate, and management practices. Credit must also be given for the amount of N derived from mineralization of soil organic N, manures, green manures, crop residues, or various types of wastes, plus that added through precipitation, foliar absorption of ammonia, biological N fixation, or nitrates in irrigation water. The deficit between crop N requirement and N from these sources is normally corrected by fertilization. A major problem exists in determining what is sufficient fertilizer N. One must consider the crop, weather, soil properties, and a multitude of fertilizer practices (carriers, time of application, rate, and placement). Also, many management practices can influence fertilizer N efficiency--tillage and crop residue placement, cropping system, irrigation practices, weed control, and others. Consequently, fertilizer N use efficiency can and does vary greatly. All these variables affect soil microbial activity and N immobilization-mineralization rates. Quantitative effects of a practice are often site-specific, and can only be predicted through process-based computer simulation models. Until such models are developed, the best approach is to fertilize according to field-calibrated soil tests. Although an empirical approach, when restricted to the area from which the field calibration was derived, this approach can provide reasonable estimates of minimum fertilizer N requirements. Previous research has shown that fertilizer use based on such recommendations reduces production costs and nitrates leaching, while maintaining yields. With continued research, well calibrated soil test recommendations for fertilizer usage can provide the accounting of N needed to minimize nitrate leaching into groundwater. (See also W91-06717) (Author's abstract)
W91-06737

FERTILIZER NITROGEN MANAGEMENT.
Colorado State Univ., Fort Collins. Dept. of Agronomy.
G. A. Peterson, and W. W. Frye.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 183-219, 3 fig, 7 tab, 53 ref.

Descriptors: *Fertilizers, *Groundwater pollution, *Nitrogen compounds, *Nonpoint pollution sources, *Water pollution control, *Water pollution sources, Agricultural practices, Cropping, Groundwater quality, Nutrient requirements, Pollutant load, Root zone.

Nitrogen fertilizer supply is the primary nutrient limitation for both total world food supply and protein content. Unfortunately, N fertilizer can also be a major contributor of N to groundwater supplies if managed improperly. 'Proper use' of N fertilizer involves accurate assessment of need before application. This in turn requires an accurate judgement of yield goal and precise soil sampling and analysis. This review paper describes how to choose a yield goal and how to sample fields precisely. Choice of fertilizer source depends on economics and the crop situation. Timing of N application to match the point of maximum uptake by the plant is vital to maximizing uptake by plants and minimizing groundwater contamination. Nitrogen management obviously has been well researched and adequate technology exists to minimize the negative effects of fertilizer N on the environment. The critical concern is applying this knowledge. Most 'mismanagement' of N fertilizer has occurred in the developed nations and so one can expect that as affluence increases in developing nations the problem of groundwater contamination with N will increase. Since 1950, farmers have had little economic incentive to be concerned with efficient N management, especially in the highly developed countries of the world, because the cost:returns ratio for N fertilizer has been low. Furthermore, the largest quantities of N fertilizer have been used in the developed countries. So, the impact on groundwater has been greatest there, and it is expected to continue. Mismanagement of N fertilizer in many soils has created an 'NO3 load' now perched between the root zone and water table that will continue to threaten groundwater supplies. Any mismanagement of irrigation water or an ill-timed natural precipitation event can move the NO3(-) into or nearer the water table. Although the 'NO3(-) load' cannot be removed below the root zone, it is imperative that overloading the soils with nitrogen, especially NO3(-), be stopped. Improved management of N applications is essential. (See also W91-06717) (Lantz-PTT)
W91-06738

ESTIMATION OF N BUDGETS FOR CROPS.
Agricultural Research Service, Lincoln, NE.
J. S. Schepers, and R. H. Fox.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 221-246, 4 fig, 4 tab, 117 ref.

Descriptors: *Agricultural practices, *Groundwater pollution, *Nitrogen compounds, *Nonpoint pollution sources, *Nutrient requirements, *Water pollution control, *Water pollution sources, Cropping, Fertilizers, Leaching, Nitrates.

Estimating N input and removal from crop production systems is one of the first considerations when evaluating management practices to minimize nitrate leaching and contamination of groundwater. Nitrogen inputs may be from natural sources such as precipitation, soil organic matter decomposition, or microbial fixation of atmospheric N. Producers can directly impact N inputs from fertilizer, manure, and nitrate in irrigation water, and indirectly affect the timing of crop N availability through the selection of tillage and cultural practices. Aside from crop N removal, most N losses are frequently difficult to precisely quantify because of complex chemical, physical, and microbial interactions. It may not be necessary to precisely quantify all N inputs and outputs from crop production systems before sound N management practices can be developed, provided producers are aware of how various management variables can be integrated to minimize nitrate leaching. (See also W91-06717) (Author's abstract)
W91-06739

IMPACT OF SOIL MANAGEMENT PRACTICES ON NITROGEN LEACHING.
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
G. W. Thomas, M. S. Smith, and R. E. Phillips.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York,

NY. 1989. p 247-276, 4 fig, 10 tab, 64 ref.

Descriptors: *Land use, *Nitrogen compounds, *Nonpoint pollution sources, *Path of pollutants, *Soil management, *Water pollution control, Conservation tillage, Leaching, Nitrates, Soil chemistry, Soil water, Tillage.

Tillage practices for row crops are presently undergoing a revolutionary change, although it is a slow revolution. Various types of 'conservation' tillage that leave a large part of the residue from the previous crop on the soil surface are increasing in importance throughout the United States and in other countries. Less disturbance of soil, and higher residue levels have immediate effects on nitrogen mineralization in soil. There are also longer-term effects on erosion, surface runoff of water and pathways for water flow through the soil. The integration of these effects would be expected to affect the amount of nitrogen leached from the soil and entering the groundwater. Tillage influences the soil water regime with respect to the effects upon evaporation from soil surfaces, paths of water flow, and pore size distribution. Nitrate leaching is considered as a function, first of soil water behavior and second of the abundance and distribution of nitrate in the soil. Amounts and forms of N in the soil are influenced by N transformations (nitrification, denitrification, and mineralization-immobilization). Soil management of water (including irrigation, drainage, and winter cropping) is therefore most important in controlling nitrate leaching. (See also W91-06717) (Lantz-PTT)
W91-06740

CROPPING SYSTEMS: ECOLOGY AND MANAGEMENT.
Minnesota Univ., St. Paul. Dept. of Soil Science.
M. P. Russelle, and W. L. Hargrove.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 277-317, 6 fig, 5 tab, 204 ref.

Descriptors: *Agricultural practices, *Cropping, *Groundwater pollution, *Land use, *Nonpoint pollution sources, *Water pollution control, Alfalfa, Fertilizers, Groundwater quality, Irrigation, Nitrates, Nitrogen compounds, Nutrient requirements, Soil water.

The judicious choice and management of cropping systems can minimize NO3(-)-N contamination of groundwater. Spatial and temporal patterns of crop N absorption should match those of N availability. Niche breadth and overlap of interplanted and sequential crops should be characterized to maximize the use of available N. Nitrogen use efficiency in monocrops can be improved by appropriate planting geometry and date, tillage, irrigation management, and cultivar selection. Cover cropping, mixed cropping, and interannual crop rotation have proven useful in many environments, but inclusion of legumes in these systems does not always reduce NO3(-)-N losses. Multiple cropping systems require careful management, especially on irrigated sands. The use of deeply rooted crops like alfalfa in semiarid regions to reduce accumulations of subsoil NO3(-)-N needs further evaluation under more humid conditions. Substitution of symbiotically-fixed N2 or animal manures for commercial fertilizer-N will not necessarily reduce NO3(-)-N losses, but the extent of groundwater contamination by symbiotically-fixed N is not known. Future development of cropping systems should attempt to control space-dependent (e.g., soil type or landscape position) and time-dependent NO3(-)-N losses from the root zone. (See also W91-06717) (Author's abstract)
W91-06741

MANAGEMENT OF WATER BALANCE COMPONENTS.
Agricultural Research Service, Fort Collins, CO. Northern Plains Area.
D. F. Heermann, H. R. Duke, and J. van Schilfgaarde.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 319-361, 9 fig, 1 tab, 18 ref.

Descriptors: *Agricultural practices, *Hydrologic budget, *Nonpoint pollution sources, *Water conservation, *Water pollution control, *Water resources management, Cropping, Drainage, Irrigation practices, Leaching, Path of pollutants, Percolation, Soil water, Water management.

Water and fertility management are important for the efficient production of crops. Since nitrate is highly soluble in water, each of the water balance components must be carefully managed to prevent the transport of nitrate out of the root zone. The water balance components include precipitation and irrigation, stored water in the soil profile, evaporation, transpiration, runoff and percolation. Precipitation management is important to maximize water storage and use. Irrigation is applied when the timing or amount of precipitation is insufficient to meet the crop demand. Surface, sprinkler and drip irrigation systems are discussed as related to management for satisfying crop water needs. When irrigations are scheduled to supplement natural precipitation, the management challenge is to measure and evaluate the irrigation to assure that water is applied in the proper amount and timing. The irrigation system must be managed to avoid excessive runoff or deep percolation. Any excess water leaving the field may be degraded in quality for further use or storage in the underground reservoir. Management of excess water through appropriate drainage is a necessary component of controlling the water balance. Unexpected rainfall can lead to excess water that must be managed. Use of irrigation systems to apply chemicals requires special management. Leaching is required but excess application can degrade groundwater and surface water supplies. Management of the water balance components also requires proper soil management to control infiltration and evaporation. (See also W91-06717) (Author's abstract)
W91-06742

MODELLING AGRICULTURE TO SUPPORT REGIONAL WATER MANAGEMENT.
Winand Staring Centre for Integrated Land, Soil and Water Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 6D.
W91-06791

SPATIAL VARIABILITY OF AN AGRICULTURAL FIELD: GEOSTATISTICAL ANALYSIS OF SOIL TEXTURE, SOIL MOISTURE AND YIELD COMPONENTS OF TWO RAINFED CROPS.
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique de Grenoble.
For primary bibliographic entry see Field 2G.
W91-06906

TURGOR MAINTENANCE IN ROSA RUGOSA GROWN AT THREE LEVELS OF NITROGEN AND SUBJECTED TO DROUGHT.
Tennessee Univ., Knoxville. Dept. of Ornamental Horticulture and Landscape Design.
R. M. Auge, A. J. W. Stodola, and D. M. Gealy.
Journal of Environmental Horticulture JEHOD5, Vol. 8, No. 3, p 108-112, September 1990. 4 fig, 1 tab, 20 ref.

Descriptors: *Drought resistance, *Horticulture, *Nitrogen, *Ornamentals, *Plant growth, *Turgidity, Drought effects, Fertilization, Fertilizers, Leaves, Moisture content, Nitrates, Nutrients, Osmotic pressure, Regression analysis, Stress, Water potentials, Water stress.

Turgor is an essential prerequisite for plant growth. The influence of nitrogen fertilization on turgor maintenance was determined in leaves from well-watered and droughted Rosa rugosa. Plants were fertilized for 60 days with a complete fertilizer with N at levels of 0, 200, or 500 ppm and then subjected to several drought cycles for 22 days. Plants receiving no N were stunted and chlorotic, but had the greatest full saturation turgor pressure and symplastic osmolality, and the lowest full saturation osmotic potential, after drought. These plants also maintained higher turgor across a range of leaf water potentials and relative water contents. Leaf water content at full turgor and relative water content at the turgor loss point were also lower in plants without N. Nitrogen treatments of 200 and 500 ppm had similar water relationship under both well-watered and drought conditions. Results suggest that growers need not be overly concerned with nitrogen fertilization regarding drought resistance in rugosa rose. (Author's abstract)
W91-06918

EFFECT OF PATTERN OF WATER SUPPLY ON VICIA FABA L.: 1. DRY MATTER PARTITIONING AND YIELD VARIABILITY.
Centre for Agrobiological Research, Wageningen (Netherlands).
C. Grashoff.
Netherlands Journal of Agricultural Science NETMAW, Vol. 38, No. 1, p 21-44, 1990. 8 fig, 3 tab, 27 ref.

Descriptors: *Beans, *Crop yield, *Irrigation, Crop production, Dry matter, Flowering, Plant growth, Rainfall, Seeds, Water shortage.

The effects of various amounts and timings of water supply during and after the flowering period were studied in faba beans. In field experiments, plenty of water during and after flowering (i-i) resulted in stimulation of vegetative growth, but reduced initial reproductive growth as well as final seed yield, compared with a control with mild water shortage during flowering but plenty of water after flowering (d-i). D-i resulted in high average seed yield of 7.0 t/ha, optimum harvest index (HI)(0.61 g/g), and relatively small seed yield range over the experiments (2.2 t/ha). In i-i, average seed yield (7.1 t/ha) did not differ significantly from d-i and HI was lower (0.57) but seed yield range was small with 1.4 t/ha. D-d, i-d, and natural rainfall control provided much lower average seed yields and a larger seed yield range; i-d also provided the lowest HI (0.54 g/g). It is concluded that differences in distribution pattern and amount of rainfall are a major reason for the variability in seed yield of faba beans. During flowering a mild water shortage might be preferable to plenty of water, to limit vegetative growth and stimulate early reproductive growth. After flowering, plenty of water is crucial for high and stable seed yield responses. (See also W91-06934) (Author's abstract)
W91-06932

MOISTURE DISTRIBUTION WITHIN A MAIZE CROP DUE TO DEW.
Agricultural Univ., Wageningen (Netherlands). Dept. of Meteorology.
For primary bibliographic entry see Field 2I.
W91-06933

EFFECT OF PATTERN OF WATER SUPPLY ON VICIA FABA L.: 2. POD RETENTION AND FILLING, AND DRY MATTER PARTITIONING, PRODUCTION AND WATER USE.
Centre for Agrobiological Research, Wageningen (Netherlands).
C. Grashoff.
Netherlands Journal of Agricultural Science NETMAW, Vol. 38, No. 2, p 131-143, 1990. 5 fig, 14 ref.

Descriptors: *Beans, *Crop yield, *Dry matter, *Irrigation, Crop production, Flowering, Plant growth, Rainfall, Regression analysis, Seeds, Water shortage.

Pod retention and pod filling of faba beans were studied under different patterns of water supply. Mild water shortage during flowering, followed by plenty of water after flowering (d-i) resulted in high seed yields at lower stem nodes. The inverse treatment (i-d), but also i-i (plenty of water during and after flowering), showed 20%-60% lower seed yields at those nodes. The quantitative consequences of these effects on the relation between total water use and seed yield were determined.

Without taking into account different water supply patterns, a linear relation between total water use (represented by total dry matter production) and seed yield already explains 75%-85% of the variation in seed yield. If different water supply patterns are included in the regression analysis, more than 90% of the variation in seed yield can be explained. The i-i patterns, compared to d-i, result in sub-optimum dry matter partitioning to reproductive organs, but show a smaller seed yield variability. This indicates that defining and maintaining the optimum level of (mild) water shortage under varying climatological conditions needs further attention. (See also W91-06932) (Author's abstract)
W91-06934

CONTRIBUTION OF OSMOTIC ADJUSTMENT TO GRAIN YIELD IN SORGHUM BICOLOR (L.) MOENCH UNDER WATER-LIMITED CONDITIONS: I. WATER STRESS BEFORE ANTHESIS.
Queensland Univ., Brisbane (Australia). Dept. of Agriculture.
For primary bibliographic entry see Field 2I.
W91-06941

CONTRIBUTION OF OSMOTIC ADJUSTMENT TO GRAIN YIELD IN SORGHUM BICOLOR (L.) MOENCH UNDER WATER LIMITED CONDITIONS: II. WATER STRESS AFTER ANTHESIS.
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
For primary bibliographic entry see Field 2I.
W91-06942

RESOURCE QUALITY AND TROPHIC RESPONSES TO SIMULATED THROUGHFALL: EFFECTS ON DECOMPOSITION AND NUTRIENT FLUX IN A NO-TILLAGE AGROECOSYSTEM.
Georgia Univ., Athens. Inst. of Ecology.
M. H. Beare, J. M. Blair, and R. W. Parmelee.
Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 8, p 1027-1036, 1989. 4 fig, 4 tab, 48 ref.

Descriptors: *Agriculture, *Decomposition, *Ecosystems, *Nutrients, *Throughfall, *Tillage, Calcium, Carbon, Microorganisms, Mineralization, Nitrogen, Phosphorus, Physical properties.

Many characteristic of no-tillage agroecosystems appear to mimic those of natural ecosystems. The effects of simulated throughfall additions on microbial and microfaunal abundances, decomposition and N, P, Ca, Mg and K flux from winter rye (Secale cereale L.) and crimson clover (Trifolium incarnatum L.) residues in a no-tillage agroecosystem were quantified during the summer of 1986. Clover residues, with higher initial nutrient concentrations and lower C-to-element ratios, had a greater rate of decomposition, greater net mineralization and higher mean concentrations of all five elements than rye. Overall mean densities of both fungi and bacteria were also greater on clover and these in turn supported greater overall mean densities of fungivore microarthropods and bacterivore nematodes. Throughfall additions to low resource quality rye residues enhanced microbial immobilization of N, P and Ca in the absence of high grazer abundances. Microfloral densities and nutrient retention were diminished under high grazer-fauna densities. No consistent throughfall effects were observed for the higher resource quality crimson clover residues. Significantly lower net N mineralization from rye (0.95 mg/g of initial litter) versus clover (12.69 mg/g of initial litter) and enhanced N retention in throughfall-treated rye suggest the limiting nature of this element. The additional amounts of N and P retained in throughfall-treated rye residues over controls were greater than could be accounted for by throughfall inputs and suggest that low level nutrient additions may stimulate immobilization of elements from other sources. (Author's abstract)
W91-06967

EFFECT OF PHOSPHORUS ON DROUGHT TOLERANCE IN CHLORIS GAYANA KUNTH AND COIX LACRYMA-JOBI L.
Hiroshima Univ. (Japan). Faculty of Applied Biological Science.
H. Saneoka, K. Fujita, and S. Ogata.
Soil Science and Plant Nutrition, Vol. 36, No. 2, p 267-274, 1990. 3 fig, 3 tab, 20 ref.

Descriptors: *Drought resistance, *Forages, *Limiting nutrients, *Nutrition, *Phosphorus, *Plant physiology, Grasses, Leaves, Nutrients, Photosynthesis, Plant growth, Plant tissues, Water stress.

To evaluate the role of phosphorus (P) nutrition on the drought tolerance of warm season forage crops, two crops were subjected to water stress at two P nutrition levels. The crops, Rhodesgrass (Chloris gayana Kunth) and Job's tears (Coix lacryma-jobi L.) are considered to be the most and the least tolerant species to water stress, respectively. Leaf water potential, stomatal resistance, leaf area, shoot and root dry weight, root development, and photosynthetic rate were recorded. Shoot and root dry weights decreased at the lower P level and under water stress in both species. Total leaf area per plant decreased by stress and it was smaller at the lower P level than at the higher P level in both species under stress conditions. The root development of both species was markedly inhibited by water stress. In rhodesgrass, total root length and root surface area at the higher P level were 2.3 and 1.7 times larger than those at the lower P level, respectively. They were 2.3 and 2.7 times larger in Job's tears. Roots were distributed in deeper layers at the higher P level than the lower P level. Leaf water potential decreased and stomatal resistance increased in the water stress treatment. Stomatal sensitivity was increased and photosynthetic rate was decreased at the lower P level under water stress conditions in both species. However, at the higher P level, plants maintained a higher value of photosynthetic rate at low water potentials compared to the lower P level. The results indicated that a higher level of P nutrition increased the ability of plants to tolerate drought in both species through the increase of total leaf area, and development and penetration of roots in deeper soil layers. (Author's abstract)
W91-06974

SOIL-WATER RELATIONS AND INTERFERENCE BETWEEN DEVIL'S-CLAW (PROBOSCIDEA LOUISIANICA) AND COTTON (GOSSYPIUM HIRSUTUM).
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
M. S. Riffle, D. S. Murray, J. F. Stone, and D. L. Weeks.
Weed Science WEESA6, Vol. 38, No. 1, p 39-44, 1990. 4 fig, 2 tab, 11 ref.

Descriptors: *Agriculture, *Cotton, *Oklahoma, *Soil water, *Soil-water-plant relationships, *Weeds, Loam, Plant growth, Precipitation, Sandy soils, Soil amendments, Soil profiles.

Soil water from plots containing cotton, devil's-claw, cotton with devil's-claw, and bare soil was measured throughout the growing season using a neutron probe and related to weed interference with the crop. Experiments were conducted in 1986 and 1987 on a Teller fine sandy loam soil (Udic Argiustoll), pH 6.9, near Perkins in north-central Oklahoma. Soil fertility levels were amended each year according to state extension soil test recommendations for cotton. 'Paymaster 145' cotton, a stormproof stripper-type cultivar was planted into an area heavily infested with devil's-claw on June 24, 1986 and June 6, 1987. The final cotton stand each year averaged 15 plants/m of row. Volumetric water content throughout the soil profile to a depth of 180 cm did not differ among treatments before the 5th or 6th week after cotton emergence. Greater water depletion occurred early in the season in plots containing devil's-claw which corresponded to a period of rapid weed growth. In plots containing only cotton, the largest reduction in water content occurred later in the season during peak bloom and early boll formation. Soil water content at depths greater than 105 cm remained unchanged in all plots throughout the season. Interference from devil's-claw reduced cotton lint yield 96% in 1986 and 46% in 1987. Higher rainfall and reduced weed populations in 1987 reduced the impact of weed interference on cotton lint yield. (Agostine-PTT)
W91-06980

EFFECT OF WATER STRESS, NITROGEN, AND GIBBERELLIC ACID ON FLUAZIFOP AND GLYPHOSATE ACTIVITY ON OATS (AVENA SATIVA).
Lincoln Coll., Canterbury (New Zealand). Dept. of Plant Science.
R. L. Dicksin, M. Andrews, R. J. Field, and E. L. Dickson.
Weed Science WEESA6, Vol. 38, No. 1, p 54-61, 1990. 7 tab, 48 ref.

Descriptors: *Fluazifop, *Gibberellic acid, *Glyphosate, *Herbicides, *Nitrogen, *Oats, *Plant growth substances, *Water stress, *Weed control, Agricultural chemicals, Grasses, Plant growth, Plant physiology.

A series of experiments was carried out on oats to test the efficacies of fluazifop and glyphosate against water-stressed plants, plants grown in low and high nitrogen (N), and plants treated with gibberellic acid (GA). Fluazifop is a member of the polycyclic alkanoic acid group of selective, postemergence herbicides used to control grass weeds in barley, wheat, rye and many broadleaf crops. Glyphosate is a nonselective, broad-spectrum, postemergence, phosphonic acid herbicide. In the laboratory, plants maintained at wilting point for 5 days before and 9 days after spraying with fluazifop (0.5 kg ae/ha) appeared healthy 32 days after herbicide application, while plants supplied with water throughout the experiment were completely chlorotic/necrotic and had main stem detachment from within the leaf sheaths. In the field, plants maintained unirrigated until 14 days after spraying with fluazifop (0.25 kg/ha) or glyphosate (0.18 kg ae/ha) showed greater tolerance of the herbicides than plants irrigated regularly. Under well-watered conditions in the laboratory and field, fluazifop (0.25 kg/ha) and glyphosate (0.18 kg/ha) were less toxic at low N than high N. Increased fluazifop activity at high N was associated with increased transport of herbicide to apical meristems. Addition of 200 microgram GA into the leaf sheaths 2 days prior to spraying with fluazifop of glyphosate increased the efficacy of both herbicides at low N. The data obtained indicate that GA has potential for increasing the performance of fluazifop and glyphosate, but only if applied sometime before spraying. It is likely that by applying the growth regulator sometime before the herbicide, rapid herbicide effects which negate growth regulator effects are avoided. (Agostine-PTT)
W91-06981

EFFECT OF IRRIGATED HORTICULTURAL CROPPING ON GROUNDWATER QUALITY: SWAN COASTAL PLAIN, WESTERN AUSTRALIA.
Agricultural Research Service, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 5G.
W91-07055

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RIVER CATCHMENT PLANNING FOR LAND DRAINAGE, FLOOD DEFENCE AND THE ENVIRONMENT.
National Rivers Authority, Thames Region, England.
J. L. Gardiner.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p

442-450, October 1990. 4 fig, 25 ref.

Descriptors: *Flood plain management, *Urban runoff, *Watershed management, Environmental policy, Geographic information systems, Land use, Local governments, Model studies, Surface water.

A study was conducted to outline the opportunities for full integration of river catchment planning in the near future. Since 1963, there has been a great deal of research on the major issues of water resources and environmental quality. Surface-water management, with the benefit of new analytical tools, can now complement these functions in the formation of river-catchment plans. This approach has been made possible by advances in analytical and computational techniques matched by hardware design. Investigations of problem areas can now be specified as part of a developing integrated river catchment plan, supported by adaptable models and capable of playing an increasingly confident role in strategic land-use planning. The most recent developments in this field concern the linking of river model ONDA to a geographic information system (GIS) and a digital ground model. Once the interrelational model has been established, a higher-level management tool will be available with the spatial facility of the GIS to extend the predictive power of the river model by indicating the type and location of attributes suffering impacts. The potential benefits lie in the interaction of local authorities and others involved in land-use planning to ensure appropriate community benefits from land-use change. (Feder-PTT)
W91-05971

DETERMINISTIC MODEL OF THE RESPONSE OF THREADFIN SHAD TO AQUATIC MACROPHYTE CONTROL.
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
P. W. Bettoli, T. Springer, and R. L. Noble.
Journal of Freshwater Ecology JFREDW, Vol. 5, No. 4, p 445-454, December 1990. 4 fig, 1 tab, 26 ref. Texas Agricultural Experiment Station Project S-6634.

Descriptors: *Aquatic weed control, *Fish populations, *Macrophytes, *Model studies, *Shad, Biomass, Carp, Chlorophyll a, Computer models, Deterministic models, Lake Conroe, Sensitivity analysis, Texas.

A computer simulation model was developed to investigate the relationships between aquatic macrophytes, chlorophyll a, and threadfin shad (Dorosoma petenense) abundance in Lake Conroe, Texas. Aerial coverage of vegetation was used as a driving variable in the model to regulate algal biomass in the limnetic zone, larval shad survival, and adult reproductive fitness. Empirical data used in model development were collected before and after grass carp Ctenopharyngodon idella were stocked in 1981-1982 to control over 3,500 hectares of submersed vegetation. Complete vegetation control by 1983 resulted in increased chlorophyll a concentrations in the limnetic zone and increased threadfin shad abundance. The model plausibly accounted for the positive response by the shad population but responded slower than the real system to macrophyte removal. Sensitivity analysis revealed the model was most sensitive to larval mortality rates and the functional form of the relationship between macrophyte abundance and chlorophyll a concentrations. (Author's abstract)
W91-06015

EFFECT OF DIFFERENT TYPES OF FOREST MANAGEMENT ON THE TRANSFORMATION OF RAINFALL ENERGY BY THE CANOPY IN RELATION TO SOIL EROSION.
Silsoe Coll. (England). Dept. of Field Engineering.
J. Brandt.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 213-222, 2 fig, 1 tab, 22 ref. Natural Environment Research Council Studentship number GT4/82/AAPS/59.

Descriptors: *Canopy, *Forest hydrology, *Forest management, *Model studies, *Rainfall impact, *Rainfall infiltration, *Soil erosion, *Watershed management, Brazil, Hydrologic models, Kinetic energy, Rainfall intensity, Rainfall penetration, Throughfall.

Rainfall energy and intensity are commonly used in a model describing the initiation of soil erosion by splash on a bare soil surface. The effects of a vegetation canopy on splash may be incorporated into such models by considering the change in rainfall drop-size distribution by the canopy. Throughfall kinetic energy per unit volume has been shown to be independent of both rainfall energy and intensity and to be determined by processes operating within the canopy. Total throughfall kinetic energy for any storm may be simulated if the frequency distribution of the values of kinetic energy per unit volume is known. At a basic level the frequency distribution of total kinetic energy values may be simulated from random values of mean kinetic energy and total throughfall depth. Experimental work to determine values of kinetic energy per unit volume of rainfall and throughfall was carried out at three sites (open, single canopy, and multiple canopy) in a mature rain forest in Brazil during August and September 1984. Kinetic energy per unit volume of rainfall samples were normally distributed with a mean of 14.7 J/mm/sq m. The mean values of kinetic energy for the single and multiple canopies are higher than those of the rainfall. While rainfall kinetic energy per unit volume correlated well with intensity, the throughfall energy did not, showing that at any time the kinetic energy per unit volume of throughfall is not dependent on the rainfall energy, has a different range and distribution from that of the rainfall, and is determined by processes operating within the canopy. Refinement of the model will come in reducing the range of possible values of kinetic energy per unit volume at any period during the storm. (See also W91-06510) (Fish-PTT)
W91-06530

STUDIES ON THE HYDROLOGICAL PROCESSES IN THE FOREST DRAINAGE BASINS OF THE WESTERN GHATS OF INDIA.
Centre for Water Resources Development and Management, Calicut (India).
E. J. James, P. K. Pradeepkumar, G. Rangana, I. V. Nayak, and T. B. Ravi.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 223-229, 6 fig, 2 tab, 2 ref.

Descriptors: *Deforestation, *Forest hydroiogy, *Forest watersheds, *India, *Unit hydrographs, *Watershed management, Drainage basins, Evapotranspiration, Exploitation, Hydrographs, Interception loss, Rainfall-runoff relationships, Sediment yield.

Three sets of drainage basins of about 2 sq km have been monitored for two years to study the impact of deforestation on hydrological parameters in the Western Ghats region of India. Each set consisted of separate dense forest, partially-exploited and fully-exploited basins. Unit hydrographs have been evolved for each of the drainage basins and compared. The results reveal that the unit hydrograph changes its shape considerably with even partial exploitation of the forests of the Western Ghats. The interception losses are of the order of 10% that of the rainfall in a typical mixed forest of the region. Sediment yield from exploited basins was computed as four times more than that of forest basins. Potential evapotranspiration was found to be higher from the exploited basins. (See also W91-06510) (Author's abstract)
W91-06531

AMOUNT OF RUNOFF AND SOIL LOSSES FROM VARIOUS LAND-USE SAMPLING PLOTS IN SAKOLNAKORN PROVINCE, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Chee Watershed Research Station.
W. Putjaroon, and K. Pongboon.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 231-238, 2 tab, 11 ref.

Descriptors: *Forest hydrology, *Land use, *Runoff, *Soil erosion, *Thailand, *Watershed management, Contour irrigation, Deforestation, Erosion control, Forest watersheds, Land management, Mountains, Sediment transport, Sediment yield.

Soil erosion is the most important problem of land management in Thailand, aggravated by the young and mountainous geologic formation, and the rugged and steep physiographic terrain with rather erosive soils. To utilize the mountainous drainage basins in northeastern Thailand to meet both socio-economic and environmental demands, information on the environmental impact of converting forest land into various types of land use must be obtained and considered in land use planning. A study was performed to investigate the amount of surface runoff and sediment yield from various forest land-uses in northeastern Thailand, and to suggest a proper method for soil erosion control. Six 2 x 10 m runoff plots were set up in dry dipterocarp forest, abandoned fields (open land forest), and contour furrowing agriculture. Each area had similar slope and aspect. The average soil losses from dry dipterocarp forest, open land forest, and contour furrowing agriculture were 664, 1,425, and 430 kg/ha, respectively. Average runoff from dry dipterocarp forest, abandoned fields, and contour furrowing agriculture was 1,529, 2,702, and 1,317 cu m/ha, respectively. Abandoned fields averaged 2.15 times the soil losses and 1.77 times the surface runoff of forest land. To reduce the soil losses and runoff from open land, proper land management or soil erosion control methods such as control furrowing agriculture were shown to be effective. (See also W91-06510) (Fish-PTT)
W91-06532

GEOMORPHIC AND VEGETATIVE RECOVERY PROCESSES ALONG MODIFIED TENNESSEE STREAMS: AN INTERDISCIPLINARY APPROACH TO DISTURBED FLUVIAL SYSTEMS.
Geological Survey, Nashville, TN.
A. Simon, and C. R. Hupp.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 251-262, 6 fig, 1 tab, 15 ref.

Descriptors: *Channel morphology, *Flood control, *Fluvial sediments, *Forest hydrology, *Riparian vegetation, *Tennessee, *Watershed management, Channel accretion, Channel erosion, Channel stability, Dendrochronology, Flood channels, Flood plain management, Geomorphology, Stream banks, Vegetation regrowth.

The sand-bed stream channels of the Obion-Forked Deer River basin, in West Tennessee, periodically have been dredged and straightened since the turn of the century to reduce flood magnitude and frequency. Changes in channel morphology and the sequence of channel forms were determined from channel surveys and field reconnaissance (1981-1986), construction plans, and specific gage data. Dendrochronologic and dendrogeomorphic analyses of riparian vegetation yielded information about channel widening, bank accretion, and timing of initial bank stability. It was found that channel bed, banks, and flood plains are systematically adjusting their form and vegetative patterns over time and space in response to the latest episode of major channel modifications (1959-1973). Headward-progressing degradation heightens and steepens the loess-derived banks and causes channel widening (up to 1-4 m/year) by mass-wasting processes. With time, aggradation reduces bank heights and continued mass failures reduce bank angles causing low-bank surfaces to stabilize and become revegetated. Riparian species characterize various stages of channel adjustment and are associated with specific geomorphic processes. Through ordination techniques, a previously-described six-stage model of channel evolution is supported by species presence data, and strongly

suggests that patterns of species distribution may be used to infer ambient bank stability. (See also W91-06510) (Author's abstract)
W91-06534

FOREST HARVEST, SNOWMELT AND STREAMFLOW IN THE CENTRAL SIERRA NEVADA.
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
L. H. MacDonald.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 273-283, 3 fig, 18 ref.

Descriptors: *Forest hydrology, *Sierra Nevada, *Snow accumulation, *Snow management, *Snowmelt, *Streamflow, *Watershed management, California, Deforestation, Flow discharge, Forest watersheds, Isotopic tracers, Rainfall-runoff relationships, Simulation analysis, Soil water.

Forest harvest techniques have often been suggested as a means of increasing snow accumulation and beneficially delaying snowmelt in the Northern and Central Sierra Nevada mountains in California. To test the effect of such management practices on streamflow, extended snowmelt was simulated in June 1985 on four 960-sq-m plots in a 50-ha drainage basin. Less than 1% of a bromide tracer in the simulated snowmelt was detected at a downstream weir through the summer and early fall of 1985. Although significant increases in the water table and soil moisture content were found in the treated plots and, in some cases, downslope, the simulated snowmelt apparently did not substantially increase streamflow in 1985. The consistently high concentrations of bromide observed at the weir in 1986 are believed to be a function of basin lithology. The results to date cast doubt on the linkage that can be made between an increase in snow water equivalent on the hillslope and downstream discharge. (See also W91-06510) (Author's abstract)
W91-06536

SNOW REDISTRIBUTION: STRIP CUTS AT YUBA PASS, CALIFORNIA.
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
B. J. McGurk, and N. H. Berg.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 285-295, 3 fig, 5 tab, 6 ref.

Descriptors: *California, *Forest hydrology, *Forest watersheds, *Snow management, *Water management, *Watershed management, Canopy, Rainfall-runoff relationships, Runoff volume, Snow cover, Snow depth, Snowmelt, Snowpack, Water resources management.

In much of the semiarid western United States, water is a critical resource that is often in short supply. In spite of extensive water resource development, continued growth has created a demand for either more water or more efficient management and use of existing supplies. It has been found that forest cutting patterns affect snow redistribution, and, because small plot studies were inconclusive, basin-sized cuts were planned in various cover types and mountain ranges to evaluate harvest patterns as a snow management and water augmentation tool. Five east-west strips were harvested in 1962 to test the potential for snow redistribution in California's snow zone. Snow depth and water equivalents were generally significantly greater in the strip cuts than in the forest. Strips one tree height in width had deeper snow and more water than strips two tree heights wide. Although snow redistribution did occur, an early summer survey indicated that snow in the cut strips melted much faster than that in the forest. It appears that either the strips were too wide to adequately shade the snowpack, or the east-west orientation of the strips was incorrect. Because no stream gage was installed, whether the observed snow redistribution had any effect on runoff volumes or timing cannot be determined. (See also W91-06510) (Fish-PTT)
W91-06537

MANAGEMENT OF FORESTS WITH WATER CONSERVATION FUNCTION.
Vyskumny Ustav Lesneho Hospodarstva, Zvolen (Czechoslovakia).
V. Krecmer, and V. Perina.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 475-480, 1 tab, 9 ref.

Descriptors: *Czechoslovakia, *Forest hydrology, *Forest management, *Forest watersheds, *Land management, *Water conservation, *Watershed management, Cost-benefit analysis, Economic aspects, Engineering, Industrial production, Runoff, Soil conservation.

Approximately 33% of Czechoslovakia is forested, and about 44% of its forest area is important to water and soil conservation efforts. Management of these forests should be an integral part of the water management system; hydrological and ecological knowledge must be applied to incorporate nonproductive forest functions into regimes of forest management. Three case studies were examined to compare the additional costs of land management for soil and water protection to the cost of remedial engineering measures that would have to be taken to counteract the effects of timber-only management on water quality, erosion, or flood flows. The water conservation function of forestry was evaluated in the drainage basin of a water supply barrage with an 80% forest cover; the calculations showed that the multipurpose system of forest management was 11-fold more effective than the construction of a new sediment trap. The economic effectiveness of the runoff detention and soil protection function of mountain forests was analyzed in an area of emission-devastated forest; the economic efficiency of the forestry-tended effects was 2.2-fold higher than the substitutional measures within the limits of adequate protection of an industrial basin at the foot of the mountain range against floods. A third calculation for areas not as economically significant for industrial production was made for the upstream basin of a forest river, assuming that changes in the runoff regimen produced corresponding changes in the degree of flood damage in the national economy; nonproductive activity in forests in territories not intensively exploited is economically-effective only if the costs of functional measures in the forests are low. In all cases, multipurpose land management proved to be cost effective. (See also W91-06510) (Fish-PTT)
W91-06554

DISSOLVED ORGANIC CARBON IN FORESTED AND CUTOVER DRAINAGE BASINS, WESTLAND, NEW ZEALAND.
McGill Univ., Montreal (Quebec). Dept. of Geography.
T. R. Moore.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 481-487, 2 fig, 2 tab, 15 ref.

Descriptors: *Dissolved organic carbon, *Drainage effects, *Forest hydrology, *Forest management, *Forest watersheds, *Watershed management, Catchment areas, Hydrological regime, New Zealand, Nutrient concentrations, Soil properties, Stream discharge.

Dissolved organic carbon (DOC) is an important component of water quality yet there are few studies of the effect of forest management on DOC and these have contradictory conclusions. Studies of DOC were conducted over five months at two sets of basins near Reefton, South Island, New Zealand. The Maimai set of eight steep, well-drained basins had stream DOC concentrations ranging from 2 to 18 mg/L which were positively related to discharge and with the cutover basins having higher DOC values than the two controls. In-channel debris and the burning of slash appear to be major controls on the stream DOC levels. The Larry River set of three flat, poorly-drained basins had DOC concentrations of 25 to 55 mg/L with a negative relationship with discharge and with the drained and planted basins lower in stream DOC than the control. Differences in DOC fluxes between the two sets and between the undisturbed and disturbed basins can be related to differences in hydrologic regime and soil characteristics. (See also W91-06510) (Author's abstract)
W91-06555

REFORESTATION: ON-SITE EFFECTS ON HYDROLOGY AND EROSION, EASTERN RAUKUMARA RANGE, NEW ZEALAND.
Forest Research Inst., Christchurch (New Zealand). Forest and Wildland Ecosystems Div.
A. J. Pearce, C. L. O'Loughlin, R. J. Jackson, and X. B. Zhang.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 489-497, 1 fig, 15 ref.

Descriptors: *Forest hydrology, *Forest watersheds, *Land management, *New Zealand, *Reforestation, *Soil erosion, *Watershed management, Annual runoff, Canopy, Erosion control, Gully erosion, Interception loss, Landslides, Roots, Sediment erosion, Sediment transport, Soil water.

Between 1960 and 1986 some 400 sq km of rapidly eroding hill country underlain by clay-rich shales and fine sandstones in the eastern Raukumara Range, New Zealand, were reforested with plantations of Monterey pine, Pinus radiata. The reforestation project was studied to determine the on-site effects on erosion and hydrology, based on a number of process studies in Mangatu State Forest, the oldest and largest of the forest areas involved in the project. It was found that the annual runoff was reduced by 170-400 mm/year. Soil water contents are lower than under pasture for most of the year, with a 3-4 month winter period of high soil water content compared to 6-8 months before reforestation. Interception loss in the forest canopy is the principal contributing factor. Roots of mature stands have penetrated the upper 1-1.5 m of earth flows, which are typically 5-7 m thick. Earth flow movement rates and erosion by earth flows have decreased by a factor of about 10 because of the lower soil water contents and the effects of tree roots in creating a reinforced, semi-rigid upper layer of the flows. Reforestation has had little effect on erosion by isolated, large gully-mass movement complexes, which continue to supply large sediment volumes to rivers. (See also W91-06510) (Fish-PTT)
W91-06556

CARNATION CREEK, CANADA--REVIEW OF A WEST COAST FISH/FORESTRY WATERSHED IMPACT PROJECT.
Pacific Forestry Centre, Victoria (British Columbia).
For primary bibliographic entry see Field 4C.
W91-06560

SOURCE OF INCREASED STORMWATERS AFTER FOREST OPERATIONS.
Virginia Polytechnic Inst. and State Univ., Blacksburg. School of Forestry.
For primary bibliographic entry see Field 4C.
W91-06561

MULTICRITERION FOREST WATERSHED RESOURCES MANAGEMENT.
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 6A.
W91-06569

EFFECTS OF WOODY DEBRIS REMOVAL ON SEDIMENT STORAGE IN A NORTHWEST CALIFORNIA STREAM.
Redwood National Park, Orick, CA.
For primary bibliographic entry see Field 2J.
W91-06634

Group 4A—Control Of Water On The Surface

STREAM CHANNEL RESPONSE TO THE REMOVAL OF LARGE WOODY DEBRIS, LARRY DAMM CREEK, NORTHWESTERN CALIFORNIA.
California Univ., Santa Barbara. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W91-06635

CONSERVATION OF FISH HABITAT IN STREAMS BY THE METHOD OF LOW DAMS SERIES.
Toyama Prefectural Coll. of Technology, Kosugi (Japan).
For primary bibliographic entry see Field 8I.
W91-06637

DISTRIBUTION AND ABUNDANCE OF LARVAL COQUILLETTIDIA PERTURBANS IN A FLORIDA FRESHWATER MARSH.
Polk County Board of Commissioners for Environmental Services, Bartow, FL.
For primary bibliographic entry see Field 2H.
W91-06824

EFFECTS OF CONTROLLED BURNING ON AEDES TAENIORHYNCHUS EGGS IN AN ABANDONED RICE IMPOUNDMENT IN SOUTH CAROLINA.
Citadel, Charleston, SC.
F. L. Wallace, M. A. Tidwell, D. C. Williams, and K. A. Jackson.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 3, p 528-529, September 1990. 2 tab, 6 ref.

Descriptors: *Insect control, *Mosquitoes, *South Carolina, Eggs, Larvae, Population density, Rice fields, Wetlands impoundments, Wildlife management.

Various management practices have been employed in abandoned rice field impoundments in order to provide a measure of mosquito control. Two practices commonly employed are controlled flooding and burning. Controlled burning reduced the number of viable eggs in an Aedes population. The study site was an impounded 11.3 ha rice field selected for its high concentration of Ae. taeniorhynchus, which observations and laboratory studies showed to be the only species of mosquito using the impoundment for oviposition. Each site was staked off into 3x3 m plots. Twenty random soil samples were taken from each plot, brought to the laboratory and irrigated. After 24 h, the larvae were sieved out and counted. Such samples were taken immediately before and after burning. Of the six plots treated in 1986, 120 samples yielded a total of 8,295 larvae, while the same number of samples only yielded 31 larvae after burning. In 1987, 300 samples yielded 28,868 larvae before the burn and 7,264 after it. The effectiveness of the burn was related to the amount of rainfall, surface moisture and dry vegetation. A greater reduction in viable eggs occurred when the burn was close to the ground. Variable results were achieved if the surface was moist but there was a significant reduction in the number of viable eggs, due to a heavy amount of dry vegetation accompanied by low rainfall. In conclusion, winter months may be the best time to burn, since the amount of dry vegetation is greatest and the chances are better for an extended dry period. (Doyle-PTT)
W91-06826

SEDIMENT TRANSPORT IN THE LOWER PUYALLUP, WHITE, AND CARBON RIVERS OF WESTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W91-07045

SOME FACTORS AFFECTING EROSION OF BED CHANNELS PROTECTED WITH RIPRAP.
Sao Paulo Univ., Sao Carlos (Brazil). Dept. de Hidraulica e Saneamento.
For primary bibliographic entry see Field 2J.
W91-07071

4B. Groundwater Management

MANAGEMENT OF GROUND-WATER RESOURCES USING SIMULATION MODELS.
National Geophysical Research Inst., Hyderabad (India).
For primary bibliographic entry see Field 2F.
W91-06900

4C. Effects On Water Of Man's Non-Water Activities

RAIN AND URBAN STORMWATER QUALITY.
Instituto de Pesquisas Hidraulicas, Porto Alegre (Brazil).
For primary bibliographic entry see Field 5B.
W91-06053

URBAN STORMWATER INFILTRATION: PURPOSES, IMPLEMENTATION, RESULTS.
Georgia Univ., Athens. School of Environmental Design.
For primary bibliographic entry see Field 5E.
W91-06228

GROWTH OF SLASH PINE PLANTED IN SOIL DISTURBED BY WET-WEATHER LOGGING.
Southern Forest Experiment Station, Pineville, LA.
A. E. Tiarks.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 3, p 405-408, May/June 1990. 3 fig, 2 tab, 11 ref.

Descriptors: *Forest management, *Logging, *Pine trees, *Productivity, *Soil-water-plant relationships, Agricultural practices, Bioindicators, Fertilization, Growth rates, Lumber industry, Saturated soils.

Timber harvest of a mature pine stand when the soil was saturated caused rutting, displacement, and puddling of the soil. Potential change in soil productivity was evaluated using the growth of slash pine (Pinus elliottii var. elliottii Engelm.) seedlings as a biological index. Pine growth on plots logged when the soil was dry was used as the standard for normal productivity. At age 5, the average height of slash pine planted on the wet-logged plots was not significantly different than on dry-logged plots. Detailed mapping showed that about 9% of the logged site was severely rutted. Pines planted on these severely rutted areas were 1.9 m in height, compared to 2.8 m for pines planted on areas undisturbed by logging. This reduction in growth is significant according to nonparametric testing. Filling in the ruts with a clearing blade while shearing stumps before planting the seedlings restored site productivity. Application of 56 kg/ha of phosphorous increased pine height growth 0.85 m on both the wet-logged and dry-logged plots. (Author's abstract)
W91-06275

LAND-LEVELING EFFECTS ON SOIL TEXTURE, ORGANIC MATTER CONTENT, AND AGGREGATE STABILITY.
Agricultural Research Service, Bushland, TX. Conservation and Production Research Lab.
For primary bibliographic entry see Field 3F.
W91-06276

HISTORICAL CHANGES IN THE COLUMBIA RIVER ESTUARY.
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 2L.
W91-06288

GRAZING IMPACTS ON INFILTRATION IN MIXED PRAIRIE AND FESCUE GRASSLAND ECOSYSTEMS OF ALBERTA.
Alberta Univ., Edmonton. Dept. of Soil Science.
M. A. Naeth, R. L. Rothwell, D. S. Chanasyk, and A. W. Bailey.
Canadian Journal of Soil Science CJSSAR, Vol. 70, No. 4, p 593-605, November 1990. 5 fig, 1 tab, 29 ref.

Descriptors: *Alberta, *Grazing, *Infiltration capacity, *Range management, *Soil-water-plant relationships, Canada, Ecosystems, Fescues, Grasslands, Infiltration rate, Infiltrometers, Prairies, Vegetation effects.

Infiltration capacity is generally reduced with increasing grazing intensity and reduced range condition, mainly through vegetation and litter removal, soil structure deterioration, and compaction. Only one study has documented the effect of grazing on Canadian rangelands, necessitating further investigation. Impacts of long-term grazing on infiltration were assessed in mixed prairie and fescue grassland ecosystems of southern and central Alberta, Canada. Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Ungrazed controls were evaluated at each site. Infiltration was measured with double ring infiltrometers. Heavy intensity and/or early season grazing had greater impact on infiltration than light intensity and/or late season grazing. In mixed prairie, initial and steady state infiltration rates in the control were 1.5 and 1.7 times higher, respectively, than those in the early season grazed treatment. In parkland fescue, initial rates were lowest in June grazed treatments and steady state rates were highest in light autumn grazed and control treatments. Initial infiltration rates in foothills fescue control and light grazed treatments were 1.5-2.3 times those in heavily and very heavily grazed treatments. Steady state rates were 1.5-2 times higher in lightly grazed and control treatments than in moderately, heavily and very heavily grazed treatments. (Author's abstract)
W91-06406

SMALL CATCHMENT STUDIES OF MAN'S IMPACT ON FLOOD FLOWS: AGRICULTURAL DRAINAGE AND PLANTATION FORESTRY.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06491

POSSIBILITY OF MATHEMATICAL MODEL APPLICATION TO EVALUATE MAN'S ACTIVITY EFFECTS ON RAINFALL RUNOFF HYDROGRAPH.
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
For primary bibliographic entry see Field 2E.
W91-06493

NEAR SURFACE HYDROLOGICAL PROCESSES UNDER CHANGING LAND USE IN HUMID-EQUATORIAL CONDITIONS.
National Univ. of Singapore.
A. Rahman.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 331-340, 2 fig, 4 tab, 16 ref.

Descriptors: *Data analysis, *Hydrologic data, *Hydrologic models, *Model studies, *Rainfall-runoff relationships, *Singapore, *Streamflow forecasting, *Urban hydrology, Base flow, Forest watersheds, Hydraulic conductivity, Infiltration, Land use, Surface-groundwater relationships, Time series analysis, Vegetation effects.

Rapid economic development has resulted in rapidly changing land use in Singapore. Forests, low-level vegetation including grass, and built-up areas cover most of the country. The near-surface hydrological processes were monitored to determine mainly their contribution to runoff on various dif-

ferent land covers in Singapore. Three types of analyses having decreasing physical study area size were conducted: (1) analyses of short-term (few years) rainfall-runoff data from drainage basins under three dominant ground covers (trees, grass, and built-up areas); (2) analyses of longer-term data (several years) from a semi-urban drainage basin undergoing rapid urban development; and (3) measurement of near-surface hydrological parameters such as infiltration rates and saturated hydraulic conductivity under various types of ground covers and soils. All the studies clearly indicated a significant decrease in subsurface flow and proportional increase in runoff as vegetation cover decreased. (See also W91-06461) (Author's abstract)
W91-06494

STUDIES ON THE DETERMINATION OF ANTHROPIC INFLUENCES ON THE HYDROLOGICAL REGIME IN SMALL BASINS.
Institutul de Meteorologie si Hidrologie, Bucharest (Romania).
S. Blidaru, M. J. Adler, E. Dragoi, T. Nicolae, and V. Oancea.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 341-360, 11 fig.

Descriptors: *Erosion, *Hydraulic structures, *Hydrologic models, *Land use, *Rainfall-runoff relationships, *Romania, Agriculture, Erosion control, Forestry, Mathematical models, Terrain, Time series analysis.

Intensive use of land and water involving complex structures built in watersheds necessitates the development of special approaches for studying and forecasting the effects of man's activities on the natural runoff regime. Modeling approaches were assessed in relation to the following types of problems: (1) analysis of the influence of hydraulic structures on runoff; (2) the regulating role of forests in the hydrological pattern; (3) influence of the antierosional works on the maximum runoff; (4) the effect of antierosional structures on solid transport in small basins tributary to reservoirs; (5) effect of the type of crop on the runoff coefficient; and (6) influence of irrigation on the hydrological pattern. Trend analysis is adequate for analyzing the influence of agricultural and silvicultural activities on natural flow in Romania when sufficiently long series are available; rainfall-runoff models also can be used. Under conditions of rapid development, rainfall-runoff models are the best approach. Rainfall-runoff models are applicable for hill zones where the modifications caused by man's activity cover easily erodible terrain, where deforestation and abrupt changes in crop can amplify the maximum runoff, enhance erosion, and cause landslides. In the lowlands, hydrological balance models should be provided with sufficiently detailed structure to enable consideration of the hydrological components in agricultural crop modeling. (See also W91-06461) (Rochester-PTT)
W91-06495

ESTIMATION OF CHANGES OF RUNOFF FROM URBANIZED AND INDUSTRIALIZED CATCHMENT.
Institute of Meteorology and Water Management, Katowice (Poland).
I. Holda, L. Osrodka, and M. Wojtvlak.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 403-407, 4 fig.

Descriptors: *Data analysis, *Hydrologic data, *Model studies, *Poland, *Runoff, *Streamflow forecasting, *Urban hydrology, *Urbanization, Effluents, Klodnica catchment, Silesia, Statistics, Time series analysis.

Intensive economic activity, exploitation of raw materials, and progressive urbanization have substantially changed the water relations in the Silesia region (Poland). An attempt was made to employ statistical methods to estimate the changes in runoff brought about in the Klodnica catchment (upper Silesian industrial district) by urbanization and industrialization. Regression analysis was applied to mean annual river flows of the Klodnica River for the period 1906-1985. Whereas runoff clearly increased over this period, analysis of precipitation data for the same period showed that precipitation fluctuated considerably, but did not increase. In fact a very slight decline is apparent in the regression line. Further analysis demonstrated that the share of anthropogenic waters in the real runoff of Klodnica's catchment was not significant before 1950. Since then, a constant increase in runoff and an increase in the percentage share of the runoff consisting of anthropogenic waters have been observed. The main cause is the significant intensification of industry and urbanization in the district after World War II. (See also W91-06461) (Rochester-PTT)
W91-06500

NTNF--PROGRAMME ON ENVIRONMENTAL IMPACTS ('MVU'): RESEARCH AND REFERENCE CATCHMENTS PROJECT ('FORSKREF').
Oslo Univ. (Norway). Lab. for Freshwater Ecology and Inland Fisheries.
S. J. Saltveit, I. Blakar, J. Heggenes, and J. Skurdal.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 467-478, 5 fig, 1 tab, 3 ref.

Descriptors: *Dam effects, *Environmental impact, *Experimental basins, *Monitoring, *Norway, Aquatic habitats, Atna River, Chernobyl accident, Fish, Gaula River, Long-term studies, Numedalslagen River, Path of pollutants, Radioactive fallout, Radioactivity.

The project 'Research and Reference Catchments' ('Forskref') aims at studying the effects of environmental impacts (MVU) by establishing a system of reference catchments/watercourses. These permit the study of long-term changes and enable the separation of the consequences of human impacts from those due to natural environmental variation. 'Forskref' also aims at stimulating cooperation among the various Norwegian research institutions covering in the aquatic sciences. 'Forskref' studies are envisaged as divided into basic studies, long-term studies, and fundamental research. At present activity is associated mainly with the Atna, Gaula, and Numedalslagen watercourses, where major research and administrative institutions are participating. Atna is the only catchment in southeastern Norway in which water quality has been monitored in detail over several years. This extensive program has permitted quantification, both in precipitation and lake waters, of radionuclides originating from the nuclear reactor accident at Chernobyl. Fallout over Atna was dated at 28 April 1986, and its effect could be seen shortly afterwards in fish. The increase in radioactive cesium levels in fish continued throughout the summer and was still high three years after the accident. Fish habitat has been studied in several rivers and related to substrate, water depth, and water velocity. These studies form part of the evaluation of the Physical Descriptive Watercourse model (FBV). (See also W91-06461) (Author's abstract)
W91-06507

FOREST HYDROLOGY AND WATERSHED MANAGEMENT.
Proceedings of an International Symposium held during the XIXth General Assembly of the International Union of Geodesy and Geophysics, Vancouver, British Columbia, Canada, August 9-22, 1987. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. 625 p. Edited by R. H. Swanson, P. Y. Bernier, and P. D. Woodard.

Descriptors: *Acid rain, *Forest hydrology, *Forest watersheds, *Land management, *Symposium, *Watershed management, Acid rain effects, Deforestation, Erosion, Hydrologic models, Hydrological regime, Model studies, Reforestation, Research priorities, Sedimentation, Snow, Soil water, Water quality, Water resources management, Water yield.

An international symposium which took place in August 1987 addressed both forest hydrology and watershed management, in order to focus the attention of researchers on the unsolved problems of land management, to determine if the available management methods derived from hydrological research are suitable to the needs of land managers, and to provide a source document that both researchers and managers could refer to for guidance in the selection of research topics or in the selection of management tools. Watershed management can be thought of as the applied field of forest hydrology. However, as the papers presented at this symposium make clear, the application of hydrologic principles to watershed management is not simple even if the land use seems to be simple. Seven of the papers deal in a broad sense with attempts to manage watersheds; ten papers describe effects of operational management (as opposed to research tests) on water yield or quality; ten papers deal with means or methods for extrapolating research results to management situations. Several papers report on highly interactive links between practitioner and researcher. The papers were published under the following headings: hydrologic effects of acid precipitation; hydrologic processes--erosion and sedimentation; hydrologic processes--snow hydrology; hydrologic processes--soil moisture and soil water chemistry; watershed hydrology; and water simulation. (See W91-06511 thru W91-06569) (Fish-PTT)
W91-06510

STREAM ACIDIFICATION RESULTING FROM AFFORESTATION IN THE UK: EVALUATION OF CAUSES AND POSSIBLE AMELIORATIVE MEASURES.
Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
For primary bibliographic entry see Field 5B.
W91-06516

RUNOFF AND EROSION IN CLEARINGS FOLLOWING CUTTING OF THE HUMID TROPICAL FOREST (ECOULEMENTS ET EROSION SOUS PRAIRIES ARTIFICIELLES APRES DEFRICHEMENT DE LA FORET TROPICALE HUMIDE).
Office de la Recherche Scientifique et Technique Outre-Mer, Cayenne (French Guiana).
J. M. Fritsch.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 123-129, 4 fig, 2 tab, 8 ref. English summary.

Descriptors: *Clear-cutting, *Erosion, *Forest hydrology, *Grasslands, *Land clearing, *Runoff, *Watershed management, Amazon, Catchment areas, French Guiana, Grasses, Tropical regions.

Increases in runoff and erosion on two small drainage basins in French Guyana were detected, using the paired watershed method, after replacing the Amazonian forest cover with grass. One basin, with impervious soils, received a Digitaria swazilandensis cover. Annual runoff increased by a factor of 1.7, peak discharge by 1.9, while erosion increased by 3.2. The other basin, with pervious soils, was planted with Brachiaria USDA, and relative increases of annual runoff, peak discharges, and erosion were 2.9, 2.4, and 2.4, respectively. The results show that the substitution of primary forest by grass cover causes rapid drainage and mechanical erosion. (See also W91-06510) (Author's abstract)
W91-06521

METHOD FOR PREDICTING TERRAIN SUSCEPTIBLE TO LANDSLIDES FOLLOWING FOREST HARVESTING: A CASE STUDY FROM THE SOUTHERN COAST MOUNTAINS OF BRITISH COLUMBIA.
British Columbia Ministry of Environment, Victoria.
For primary bibliographic entry see Field 2J.
W91-06523

TEST OF AN ERODIBILITY RATING SYSTEM FOR THE FOOTHILLS OF CENTRAL ALBERTA, CANADA.
National Agrarian Univ., Lima (Peru). Dept. Manejo Forestal.
For primary bibliographic entry see Field 2J.
W91-06524

POSSIBLE HYDROLOGICAL AND GEOMORPHOLOGICAL CHANGES DUE TO ALTERATION OF FOREST.
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
K. Okunishi, T. Saito, and R. Yoshioka.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 173-179, 3 fig, 8 ref.

Descriptors: *Deforestation, *Forest hydrology, *Forest management, *Japan, *Landslides, *Reforestation, *Watershed management, Conifers, Cryptomeria trees, Deciduous trees, Land clearing, Land management, Soil erosion.

Effects of the alteration of a forest were examined in a small basin in Japan. Existing broad-leaved trees were replaced with sugi trees (Japanese cedars--Cryptomeria japonica). In clearing economically-useless trees, protective measures learned from past deforestation experiences, were taken against erosion and landslides. In a period of fourteen years after the forest alteration, small-scale landslides took place with no greater frequency than in the control forests. Acceleration of surface erosion was negligible. Nonetheless, a uniform forest of coniferous trees has increased susceptibility to landslides, and the harvesting of the sugi trees may result in even more landslides because of the absence of shrubs. (See also W91-06510) (Fish-PTT)
W91-06526

EVALUATION OF THE EFFECT OF DEFORESTATION ON SLOPE STABILITY AND ITS APPLICATION TO WATERSHED MANAGEMENT.
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Forestry.
For primary bibliographic entry see Field 2J.
W91-06527

STUDIES ON THE HYDROLOGICAL PROCESSES IN THE FOREST DRAINAGE BASINS OF THE WESTERN GHATS OF INDIA.
Centre for Water Resources Development and Management, Calicut (India).
For primary bibliographic entry see Field 4A.
W91-06531

DEFORESTATION AND EROSION IN THE NEPALESE HIMALAYA--IS THE LINK MYTH OR REALITY.
Land Capability Consultants Ltd., Cambridge (England).
W. J. H. Ramsay.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 239-250, 1 tab, 49 ref.

Descriptors: *Deforestation, *Forest hydrology, *Geomorphology, *Himalayan Mountains, *Nepal, *Soil erosion, Erosion rates, Geologic erosion, Gully erosion, Land management, Landslides, Mass wasting, Sediment transport, Slope stability.

Despite numerous popular accounts, data on erosion processes in the Himalaya are scarce and unreliable. Quantitative studies of mass wasting and surface erosion in Nepal were reviewed. The literature reveals a consensus that in Nepal erosion rates are naturally very high (1-5 mm/year), mass wasting is the dominant hillslope process, and geological factors (orogenic uplift) are the most important determinants of slope stability. Forest degradation and the conversion of forest to poorly-managed grazing land or rainfed terraces has resulted in increased sediment mobility through surface erosion, gullying, and shallow (< or = 3 m deep) landslides. Locally this soil loss is important agriculturally. Currently there is no evidence to link deforestation to the large, complex slope failures which mobilize most sediment. Despite high sediment delivery ratios in the Himalaya due to efficient slope/channel coupling, such increased production represents only a small portion of the total sediment contribution to river channels. However, it is of crucial importance to communities affected by the loss, and for the development of effective conservation strategies. (See also W91-06510) (Fish-PTT)
W91-06533

EFFECT OF CLEARCUTTING ON CHEMICAL EXPORTS IN LATERAL FLOW FROM DIFFERING SOIL DEPTHS ON A SUBALPINE FORESTED SLOPE.
Forest Service, Fort Collins, CO.
C. A. Troendle, and M. A. Nilles.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 423-431, 6 fig, 2 tab, 8 ref.

Descriptors: *Clear-cutting, *Forest hydrology, *Forest watersheds, *Input-output analysis, *Ion transport, *Mountain watersheds, *Soil chemistry, *Water chemistry, Cation exchange, Chemical analysis, Colorado, Flow discharge, Infiltration, Path of pollutants, Perched groundwater, Percolation, Slopes, Snowmelt, Stratified flow, Surface flow, Water quality.

A significant amount of information is available on chemical export from disturbed and nondisturbed watersheds. However, only a small portion of that information applies to watersheds in the western US. Some observations were made on chemical export from two surface/subsurface flow collection systems on the Fraser Experimental Forest in Colorado. Chemistry of lateral flow from the surface and subsurface depths on two study plots were measured for five years. Following the third year,one plot was clearcut. The seasonal average flow weighted concentrations were calculated for selected parameters from samples taken at the surface (snowpack), 0-1 m, and 1-4 m at both sites. The flow weighted average concentration of selected parameters were calculated for one of the plots for that period of time when all three layers were actually flowing. The ion concentrations in water from all three layers when flowing were more similar than for the seasonal means. The interpretation of the hydrologic response on the hillside is that meltwater infiltrates and percolates vertically until impedance to vertical movement causes input rate to exceed percolation rate. Gradually a perched water table then is built up, causing lateral flow at succeedingly shallower levels. The chemistry data support this interpretation. The majority of the cation exchange capacity is in the surface soil, all infiltrating water is exposed to the same initial exchange opportunity, and all outflow chemistry is different from the input chemistry. Clearcutting the smaller plot increased chemical export, both because two elements, NO3(-) and Cl(-), increased in concentration and because the greater flow following harvest 'flushed' more material from the system. (See also W91-06510) (Fish-PTT)
W91-06550

IMPACT OF CONIFER AFFORESTATION ON WATER QUALITY IN AN UPLAND CATCHMENT IN SOUTHWEST ENGLAND.
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
For primary bibliographic entry see Field 5C.
W91-06552

HYDROLOGY OF AN ACID WETLAND BEFORE AND AFTER DRAINING FOR AFFORESTATION, WESTERN NEW ZEALAND.
Forest Research Inst., Christchurch (New Zealand). Forest and Wildland Ecosystems Div.
R. J. Jackson.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 465-474, 2 tab, 8 ref.

Descriptors: *Acidic soils, *Deforestation, *Drainage practices, *Forest hydrology, *New Zealand, *Reforestation, *Surface drainage, *Watershed management, *Wetlands, Acidic water, Channel stability, Drainage water, Flood peak, Forest soils, Land management, Overland flow, Pine trees, Water table fluctuations.

On the west coast of South Island, New Zealand, there are about 300,000 ha of wetland which is generally level or of very low relief and has acid, infertile soils. These wetlands are present on river valley terrace systems which have been cleared of forest. Recently, large areas have been planted on land prepared by V-blading the surface to improve drainage. An intensive surface drainage system was used to improve establishment of plantations of Monterey pine (Pinus radiata) on wetlands in western South Island. The hydrology of undisturbed and drained experimental basins on a typical high terrace area with 2440 mm/year rainfall was studied to assess whether the land preparation method has contributed to these problems. Stream water is brown, naturally acid (pH approximately 4.0), and has high concentrations of dissolved organic carbon (25-55 mg/L). The water table on undisturbed wetland was nearly always at <0.5 m depth and rose rapidly during rainfall to give widespread overland flow. Quickflow contributed 70% of the 1580 mm/year runoff. The ridges formed by surface drainage works provided elevated, drier sites for trees, but the water table remained high beneath and between ridges. Draining induced higher flood peaks, and the frequency of peaks >10 L/s/ha increased greatly. Annual sediment yield increased from <1 to approximately 10 t/ha. Increased peak flows caused instability of the channel downstream from the drained area. (See also W91-06510) (Author's abstract)
W91-06553

STREAMFLOW CHARACTERISTICS OF TWO SMALL, STEEP AND FORESTED WATERSHEDS IN HIGH ELEVATION AREAS OF CENTRAL TAIWAN.
British Columbia Ministry of Forests, Kamloops. Hydrology Research Section.
J. D. Cheng, Y. J. Hsia, H. S. Lu, V. C. Liu, and C. C. Koh.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 499-508, 4 fig, 4 tab, 9 ref.

Descriptors: *Forest hydrology, *Forest watersheds, *Mountain watersheds, *Rainfall-runoff relationships, *Taiwan, *Watershed management, Evapotranspiration, Flood peak, Forestry, Land management, Landslides, Streamflow data, Typhoons, Vegetation, Water yield.

The high-elevation forested areas in the Central Mountain Range of Taiwan suffer soil erosion, landslides, and floods carrying high sediment loads during the typhoon season, even in watersheds undisturbed by man. A research program was initiated in 1969 on two small watersheds (PL-11 and PL-12) to obtain a basic knowledge of the hydrologic characteristics of undisturbed forest watersheds, to evaluate the hydrologic effects of forestry practices, and to determine if some of the designated protection forests can be harvested without causing undesirable hydrologic effects. Examination of the streamflow characteristics of these two study watersheds during a 12-year pre-logging calibration period shows that streamflow quantities and regimes reflect the strong influences of abundant and intense torrential rainfalls during the May to October typhoon season. Streamflow is highly correlated to rainfall. The PL-12 watershed generally produces higher streamflows from similar rainfall inputs than the PL-11 watershed, probably due to lower evapotranspiration losses and higher contributions from subsurface water storage. The two watersheds are closely correlated for all streamflow parameters analyzed (annual and monthly water yields, annual peak flows, stormflow amounts, peak flow magnitudes, and rising times),

suggesting the feasibility of detecting streamflow changes as a result of proposed logging in the PL-12 watershed. Despite having shallow soils and steep slopes, the study watersheds' streamflow regulation capacities are large, possibly due in part to each having good vegetation cover, showing the importance of maintaining good watershed cover for optimum streamflow regulation. (See also W91-06510) (Fish-PTT)
W91-06557

CHANGES IN STREAMFLOW PEAKS FOLLOWING TIMBER HARVEST OF A COASTAL BRITISH COLUMBIA WATERSHED.
British Columbia Univ., Vancouver. Faculty of Forestry.
D. L. Golding.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 509-517, 2 fig, 15 ref.

Descriptors: *British Columbia, *Deforestation, *Flood peak, *Forest hydrology, *Land use, *Rainfall-runoff relationships, *Watershed management, Canada, Clear-cutting, Drainage effects, Land management, Sediment erosion, Snowmelt, Storms, Streamflow data.

One of the concerns of land managers in coastal British Columbia, Canada, is the probability of increased streamflow peaks after forest harvesting, causing impairment of fish habitat and domestic water supplies caused by erosion and debris torrents. An examination was made of the effects of forest harvest on streamflow peaks for two distinct seasons, the late fall-winter season (November-March), when peak streamflow is generated by rain on a melting snowpack, and the summer season (mid June-November) when snowmelt has little, if any, influence on the hydrograph. Jamieson Creek and Elbow Creek basins were established in 1969 as treatment and control basins, respectively, of a paired-basin experiment in a drainage basin of the Vancouver, British Columbia, municipal water supply area. Changes in streamflow peaks following clear-cutting of 19.2% of Jamieson Creek experimental basin were determined. Winter storm peaks, which usually result from rain on melting snowpacks, showed a treatment-induced increase of a maximum 13.5%. There was no indication that the increases were limited to a particular storm-size class. Summer storm peaks showed no treatment-induced increase although both summer and winter storms showed significant post-treatment increase, presumably from changes in precipitation patterns resulting in storms of greater total precipitation. Peak winter flows were highly correlated with snowmelt rates. There was no difference in size of peak flow or in lag time between peak snowmelt and peak streamflow whether or not melt rates were greater in the forest than in the clearcut. (See also W91-06510) (Fish-PTT)
W91-06558

CARNATION CREEK, CANADA--REVIEW OF A WEST COAST FISH/FORESTRY WATERSHED IMPACT PROJECT.
Pacific Forestry Centre, Victoria (British Columbia).
E. D. Hetherington.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 531-538, 1 fig, 11 ref.

Descriptors: *British Columbia, *Deforestation, *Environmental impact, *Forest hydrology, *Forest watersheds, *Land use, *Stream fisheries, *Watershed management, Canada, Fish management, Flood peak, Forestry, Hydrologic models, Project planning, Streamflow, Water quality.

Coastal British Columbia, Canada, is endowed with major fish and forest resources, both of which are of vital importance to the economy. Carnation Creek is a small rainforest salmon stream located on the west coast of Vancouver Island. In 1970, a 16-year multi-agency and multi-disciplinary project was initiated to evaluate the effects of logging and silvicultural activities on the Carnation Creek watershed and communicate the results to managers of forests and fish. It was found that peak flows and water yield increased in a small tributary, groundwater levels were higher, and there were minor changes in water quality. There were also major changes in stream channel and organic debris structure, deterioration of fish habitat and spawning gravel quality, and a complex variety of effects on fish growth and survival. Ongoing communication of research findings to fishery and forestry managers and other potential users has been a major goal of the project, and includes almost 100 articles, a short information film, presentations and talks, seminars and field tours, and workshops. Carnation Creek research findings have been widely used in coastal British Columbia as a qualitative basis for on-site fish-forestry interaction evaluations and for assessment and planning of forestry development proposals. (See also W91-06510) (Author's abstract)
W91-06560

SOURCE OF INCREASED STORMWATERS AFTER FOREST OPERATIONS.
Virginia Polytechnic Inst. and State Univ., Blacksburg. School of Forestry.
C. M. Liu.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 539-544, 10 ref.

Descriptors: *Deforestation, *Environmental effects, *Forest hydrology, *Forest watersheds, *Land use, *Rainfall-runoff relationships, *Storm runoff, *Watershed management, Clear-cutting, Flood peak, Georgia, Infiltration, Soil water, Statistical analysis, Streamflow data, Transpiration, Vegetation effects.

Road construction, harvesting, site preparation, and tree planting are regarded as important causes of increased stormflow, peakflow, and sediment export from headwater areas. Twelve segments were selected from two experimental basins (one treatment and one control) in the Georgia Piedmont region to identify the cause and source of increases in stormflow and peakflow from a treatment basin after forest operations. Gaging of streamflow began in July 1974. The treatment basin was logged in the winter of 1974-75, roller-chopped in the spring and fall of 1975, and planted in March 1976. It was found that the increase in stormflow depends on the magnitude of stormflow and storm rainfall; the larger the magnitude of stormflow, the smaller the increase in stormflow, and the larger the storm rainfall, the bigger the increase in stormflow. The greater the peakflow or the higher the hourly rainfall intensity, the bigger the increase in peakflow. In undisturbed forests, nearly all precipitation infiltrates the soil mantle and becomes part of the soil water storage, highest during the dormant season and lowest during the mid to late growing season. The removal of vegetation did not greatly alter the infiltration characteristics of the experimental watersheds. The most significant response to the clear-cutting was the reduction in transpiration, resulting in higher soil water storage, which in turn resulted in greater stormflow from convergent segments (a segment whose width decreases toward the stream). Results of statistical analysis show that convergent segments are more responsive to forest practices than the rest of the basin, implying that more emphasis should be placed on terrain classification for management prescriptions. (See also W91-06510) (Fish-PTT)
W91-06561

EFFECT OF CLEARCUTTING ON STREAMFLOW GENERATING PROCESSES FROM A SUBALPINE FOREST SLOPE.
Forest Service, Fort Collins, CO.
C. A. Troendle.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 545-552, 3 fig, 3 tab, 9 ref.

Descriptors: *Clear-cutting, *Environmental effects, *Forest hydrology, *Forest watersheds, *Land use, *Mountain watersheds, *Streamflow, *Surface runoff, Colorado, Deforestation, Flood peak, Flow measurement, Groundwater movement, Rainfall-runoff relationships, Slopes, Soil water.

Numerous investigators have attempted to define the mechanisms of water movement down forested slopes. In order to better define the pathway of water movement and the processes by which melt or rain water migrates toward the stream channel, plot studies were performed on the Fraser Experimental Forest in Colorado. The flow-producing mechanisms on two forested plots (17 x 210 m and 36 x 210 m) were monitored for seven years. Surface, shallow subsurface (0-1 m), and deep subsurface (1-4 m) lateral flows were intercepted and measured, as were the fluctuation of perched water tables and soil moisture content on the two hillslopes. After the fifth season, one plot was clear-cut. Peak water equivalent in the snowpack, total flow, and peak discharge rate increased during the first full year following harvest. The timing of the peak was not affected. Observations of water movement on both study plots appears to define the streamflow-generating processes representative of the subalpine environment. (See also W91-06510) (Author's abstract)
W91-06562

EFFECT OF ASPEN HARVEST AND GROWTH ON WATER YIELD IN MINNESOTA.
North Central Forest Experiment Station, Grand Rapids, MN. Forestry Sciences Lab.
E. S. Verry.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 553-562, 4 fig, 3 tab, 11 ref.

Descriptors: *Deforestation, *Environmental effects, *Forest hydrology, *Forest watersheds, *Minnesota, *Reforestation, *Streamflow, *Watershed management, Biomass, Birch trees, Clear-cutting, Poplar trees, Rainfall-runoff relationships, Streamflow data, Water yield.

Cutting forests from well-drained mineral soils usually results in annual water yield increases, and has been reported for the first year following an aspen clear-cut in northern Minnesota. A study was made at the Marcell Experimental Forest in north-central Minnesota in a basin which was clearcut of a mature aspen-birch forest after nine years of hydrological calibration against a control basin. It was found that annual water yield increased following the clear-cutting of the aspen forest in years 1-9 and year 14 of subsequent aspen regrowth. Maximum increases of 85, 117, and 88 mm/year occurred during the first three years of regrowth. Increases in streamflow volumes from snowmelt and early spring rains were minimal and more variable after harvest and regeneration. Most of the increases occurred during the leaf-on periods, but sporadic increases occurred during the fall-early-winter recharge period as long as 15 years after harvest. Increases in water yield were best explained by changes in aboveground biomass, but precipitation, especially during the leaf-on periods, improved the relation. Increases in annual water yields became insignificant when aboveground biomass approached 57 tons/ha (17 percent of mature forest biomass at 14-15 years of age). (See also W91-06510) (Author's abstract)
W91-06563

EFFECTS OF WHOLE-TREE CLEARCUTTING ON STREAMFLOW CAN BE ADEQUATELY ESTIMATED BY SIMULATION.
Northeastern Forest Experiment Station, Durham, NH. Forestry Sciences Lab.
J. W. Hornbeck, C. A. Federer, and R. S. Pierce.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 565-573, 1 fig, 4 tab, 9 ref.

Descriptors: *Clear-cutting, *Deforestation, *Environmental effects, *Forest hydrology, *Forest watersheds, *Simulation analysis, *Streamflow

forecasting, Connecticut, Hydrologic models, Maine, Model studies, New Hampshire, Nutrients, Streamflow data, Vegetation regrowth.

Changes in streamflow due to forest harvests have traditionally been determined using paired, gaged basins. Such studies involve high costs and long calibration periods, and can seldom be replicated among or within forest types. There is a need to demonstrate that simulated effects of harvest are within acceptable error limits of actual effects. A comparison was made of measured and simulated effects on streamflow of a whole-tree clear-cut at the Hubbard Brook Experimental Forest in New Hampshire. A range of values was assigned to parameters of the BROOK hydrologic model to simulate streamflow for fast, medium, and slow regrowth on whole-tree clear-cut basins in Maine, New Hampshire, and Connecticut. Simulated increases in streamflow for the first year after harvest at the New Hampshire site ranged from 167 mm for fast regrowth to 255 mm for slow regrowth. The measured increase estimated using paired control and treatment basins was 175 mm. Simulated increases in the second year ranged from 74 to 234 mm, while the paired basin estimate was 71 mm. Annual outputs of dissolved nutrients showed only small differences when calculated with simulated versus measured streamflow. At the Maine and Connecticut sites where streamflow was not measured, simulated annual streamflow increases differed little from New Hampshire, but seasonal increases and relative increases varied considerably. The BROOK model is a viable alternative for estimating streamflow when stream gaging is impractical. (See also W91-06510) (Author's abstract)
W91-06564

SIMULATION OF EFFECTS OF FOREST GROWTH ON WATER YIELD WITH A DYNAMIC PROCESS-BASED USER MODEL.
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
R. E. Schulze, and W. J. George.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 575-584, 6 fig, 1 tab, 8 ref.

Descriptors: *Forest hydrology, *Hydrologic models, *Model studies, *Reforestation, *South Africa, *Streamflow forecasting, *Water yield, *Watershed management, Land use, Simulation analysis, Streamflow, Vegetation regrowth, Water demand, Water resources management.

Since major water resources areas in South Africa are simultaneously those suitable for afforestation with exotic timber species, conflicts between in situ users of water and downstream demands for irrigation, industrial, and domestic use have thus arisen. The effects of afforestation on water yield were reviewed. In light of research findings and the method currently used in South Africa to determine reductions of water production with afforestation, the 'ACRU' model has been adapted to account for changes in important land-use-related processes as a forest grows in time, by incorporation of a dynamic land use information file. Tests with this model on a basin in Cathedral Peak in Natal, afforested in 1951, indicate that forest hydrological effects can be modeled successfully with a dynamic land use file. The diverging trend between observed and simulated annual streamflow illustrates the influences of increased interception, transpiration, and rooting depth on water production. Statistical analysis showed that the model overestimated streamflow by 8.5% while variances of observed and simulated flow differed by 7.9%. Further model development is being undertaken to include processes such as litter interception, improved root extraction patterns, effects of different tree species, growth rates, management practices, climatic regimes, land use, and soil heterogeneity within basins. (See also W91-06510) (Fish-PTT)
W91-06565

EROSION AND SEDIMENTATION IN THE PACIFIC RIM.
Oregon State Univ., Corvallis. Coll. of Forestry.
For primary bibliographic entry see Field 2J.
W91-06570

EROSION AND SEDIMENTATION ISSUES IN PERU.
National Agrarian Univ., Lima (Peru). Dept. Manejo Forestal.
For primary bibliographic entry see Field 2J.
W91-06571

EFFECTS OF TIMBER HARVESTING ON PROGRESSIVE HILLSLOPE DEFORMATION IN SOUTHWEST OREGON.
Pacific Northwest Forest and Range Experiment Station, Juneau, AK. Forestry Sciences Lab.
For primary bibliographic entry see Field 2J.
W91-06587

HYDROMECHANICAL EROSION MODEL FOR SURFACE-MINED AREAS.
National Pingtung Inst. of Agriculture (Taiwan).
K. J. Tsai.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 249-250. 1 tab.

Descriptors: *Erosion, *Model studies, *Soil erosion, *Strip mines, Erosion control, Land use, Mathematical models, Planning, Prediction, Rainfall, Rainfall intensity, Resource management, Runoff, Sediment load, Sediment yield, Slope gradient, Soil texture, Soil transport, Soil types.

Newly developed soil erosion and sediment load prediction models have become very beneficial as design tools in developing land-use plans to control sediment loads and soil losses. An effective mathematical model was developed, based on physical processes of rainfall and runoff, to predict soil loss or sediment yield generated from mined areas. The mathematical relationships of the model were used to describe the dynamics of the erosion subprocesses, such as soil detachment and transport by rainfall and runoff. Soil samples were collected from undisturbed sites, representing the common soil characteristics of the research area, and selected from a benchmark soil for which laboratory data are available. Soil erosion data collected from simulated rainfall plots consisted of four erosion-influencing variables: slope steepness, runoff rate, rainfall intensity, and soil texture. Differences between observed and model prediction of soil loss are not highly significant. Further research should allow the development of a yearly average prediction of erosion using this model. (See also W91-06570) (Brunone-PTT)
W91-06599

INCREASED SEDIMENTATION FOLLOWING HELICOPTER LOGGING AND PRESCRIBED BURNING ON GRANITIC SOIL.
Intermountain Forest and Range Experiment Station, Boise, ID.
For primary bibliographic entry see Field 2J.
W91-06604

SEDIMENT YIELDS AND SURFACE RUNOFF FROM SIX TYPES OF AGROFORESTRY AT MAE-KLONG WATERSHED RESEARCH STATION, KANCHANABURI, THAILAND.
Royal Forest Dept., Bangkok (Thailand). Watershed Management Div.
For primary bibliographic entry see Field 2J.
W91-06605

TEST OF A SURFACE RUNOFF AND SOIL EROSION MODEL FOR FOREST ROAD SURFACES.
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 2J.
W91-06606

ESTIMATING DISCHARGE AND SEDIMENT YIELD FROM A FOREST ROAD.
Kyoto Univ. (Japan). Dept. of Forestry.
For primary bibliographic entry see Field 2J.
W91-06607

EROSIONAL EFFECTS OF ROAD CONSTRUCTION IN PI-LU EXPERIMENTAL WATERSHED.
Thu-Thai Associates, Inc., Taipei (Taiwan).
For primary bibliographic entry see Field 2J.
W91-06608

INFLUENCE OF LARGE ORGANIC DEBRIS ON CHANNEL RECOVERY IN THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA, CANADA.
D. L. Hogan.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 343-353. 6 fig, 2 tab, 21 ref.

Descriptors: *British Columbia, *Channel morphology, *Detritus, *Logging, *Queen Charlotte Islands, Channel scour, Channel storage, Coastal zones, Dam effects, Debris flow, Forest management, Forestry, Sedimentation, Stream banks, Vegetation, Watersheds.

In-stream large organic debris (LOD) characteristics were evaluated in unlogged and logged coastal watersheds. The input, storage and output components of LOD budgets, how these are altered in logged and torrented channels and how these changes influence the recovery of disturbed channels were all examined. In small and medium sized watersheds, all components of the LOD budget are altered after logging and debris torrenting. Initially, the size and abundance of debris staged to enter the stream systems are reduced. Reduction in material size leads to a shift in the orientation of debris stored within the channel zone. Consequently, the scouring and trapping functions of debris pieces are altered. A less complex morphology results, including reduced depth, width and sediment texture variability and diminished pool area. The smaller debris is less stable causing an increased tendency for the material to cluster into major debris jams; this jam stores large volumes of clastic sediment upstream and leads to reduced channel stability. Because logging and debris torrenting can affect streambank vegetation for long periods of time, it is possible that the resultant channel disturbances will not be reversed over forest management time scales. (See also W91-06570) (Author's abstract)
W91-06621

GEOMORPHIC INFLUENCES ON SEDIMENT TRANSPORT IN THE WILLAMETTE RIVER.
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 2J.
W91-06623

TRIBUTARY ENTRENCHMENT IN RESPONSE TO LOWERED BASE LEVEL BELOW A DAM.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
D. Germanoski, and D. F. Ritter.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 391-392. 1 tab.

Descriptors: *Channel erosion, *Dam effects, *Erosion, *Geomorphology, *Scour, *Sediment transport, *Tributaries, Channel armoring, Channel morphology, Slope degradation, Terracing.

Tributaries located immediately downstream from a dam respond to lowered base level by incising vertically, widening, and expanding headwardly. The amount of tributary downcutting was measured on subaerially exposed cross channel tree roots, broken off roots, root armored knickpoints, and 'within channel' terraces. Average incision measured at the mouths of all eight tributaries was 2.2 m. The two tributaries closest to the dam have

incised deeper than the other six. Channel widening results directly from vertical entrenchment, which oversteepens the channel banks and promotes bank slumping. Headward extension of the drainage network results from rejuvenation of lower-order tributaries. Root armoring of the channel bottom produces stepped longitudinal profiles and protracts the total adjustment period of the tributaries. Thus, tributary incision is episodic and the influx of high sediment discharge is out of phase from tributary to tributary. The cause of tributary entrenchment is local base level lowering below Bagnell Dam in central Missouri. Tributary entrenchment causes accelerated erosion in the drainage network and, therefore, extends the influence of the dam into areas removed from the trunk river. (See also W91-06570) (Brunone-PTT)
W91-06628

RESPONSE OF DRY CREEK, CALIFORNIA, TO LAND USE CHANGE, GRAVEL MINING AND DAM CLOSURE.
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
M. D. Harvey, and S. A. Schumm.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 451-460. 4 fig, 2 tab, 13 ref. US Army Corps of Engineers Contract No. DACW05-85-P-00464.

Descriptors: *California, *Channel erosion, *Channel morphology, *Dam effects, *Dry Creek, *Gravel mining, *Land use, *Sediment transport, Aggradation, Bedrock, Channel armoring, Channel stability, Degradation, Sediments, Sill erosion, Tributaries.

A 21.5 km reach of Dry Creek, Sonoma County, California, downstream of Warm Springs dam, was studied to determine responses to land use change, gravel mining, and dam closure. Land use changes (1850-1870) cause aggradation and then degradation, but the channel was in equilibrium by 1900. Gravel mining in Dry Creek and Russian River (1900-1950's) reduced base level of Dry Creek by 3 m. The channel degraded by an average of 3.2 m, and by 1984 mean channel width and depth, at bankfull stage, had increased from 9.8 to 101.8 m and from 1.4 to 5.8 m, respectively. Channel longitudinal profiles were not significantly different; therefore, the major response of Dry Creek to the imposed changes was an increase of width. Dam closure (1983) did not cause the expected further degradation of Dry Creek because of channel armoring, tributary contribution of sediment, emplacement of three grade-control sills, and the presence of bedrock outcrops in the channel. (See also W91-06570) (Author's abstract)
W91-06644

FORESTRY AND SEDIMENT YIELDS IN UPLAND SCOTLAND.
Stirling Univ. (Scotland). Dept. of Environmental Science.
For primary bibliographic entry see Field 2J.
W91-06649

LAND USE, EROSION RATES, AND RESERVOIR SEDIMENTATION IN A COASTAL ECUADORIAN WATERSHED.
New Mexico State Engineer Office, Santa Fe.
For primary bibliographic entry see Field 2J.
W91-06650

RESPONSE OF A NORTHERN CALIFORNIA COASTAL DRAINAGE BASIN TO LAND USE DISTURBANCE.
Humboldt State Univ., Arcata, CA. Dept. of Watershed Management.
For primary bibliographic entry see Field 2J.
W91-06651

SHORT-TERM AMPHIBIAN TOXICITY TESTS AND PARAQUAT TOXICITY ASSESSMENT.
NSI Technology Services Corp., Corvallis, OR.
For primary bibliographic entry see Field 5C.
W91-06704

COASTAL OIL DRILLING PRODUCED WATERS: CHEMICAL CHARACTERIZATION AND ASSESSMENT OF GENOTOXICITY USING CHROMOSOMAL ABERRATIONS IN CYPRINODON VARIEGATUS.
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
C. B. Daniels, C. B. Henry, and J. C. Means.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 356-371, 6 fig, 4 tab, 22 ref.

Descriptors: *Genotoxicity, *Oil industry, *Oil wastes, *Toxicology, *Water pollution effects, Chemical analysis, Coastal waters, Ecological effects, Genetics, Louisiana, Organic compounds, Toxicity.

Oil drilling operations generate very large volumes of produced waters which contain a complex mixture of subsurface water and solid and liquid geological materials, including crude oil, drilling fluids, and treatment chemicals. In coastal regions, these produced waters are discharged into fresh or brackish marshes or wetlands which also serve as the spawning sites for a wide variety of economically important species of fish and shellfish. Recently, concern has focused on potential impacts of produced waters upon these productive and sensitive ecosystems. Results are reported from investigations which characterize the chemical contaminants present in produced waters and surficial sediments collected at two sites in coastal Louisiana. Trace organic analyses of the produced waters revealed a complex and variable mixture of normal-, alkyl-, and heterocyclic polynuclear aromatic hydrocarbons. Examination of surficial and subsurface sediments demonstrate that extensive areal distribution of the produced water hydrocarbons has occurred through time. Embryonic stage genotoxicity bioassays of the produced waters indicate that the polycyclic aromatic hydrocarbons being discharged in these coastal waters cause increased mutational frequencies in Cyprinodon variegatus. Since the observation of chromosomal aberrations is usually rare in the cells of the organism and since cell replication and differentiation are maximal in the early developmental stages of these and other species of aquatic organisms, the results suggest that the potential exists for adverse effects of these discharges on estuarine productivity. Further study of the impacts of produced waters in this and other species is indicated. (See also W91-06691) (Author's abstract)
W91-06716

GROUND WATER NITRATES IN OTHER DEVELOPED COUNTRIES (EUROPE)--RELATIONSHIPS TO LAND USE PATTERNS.
BASF Aktiengesellschaft, Limburgerhof (Germany, F.R.). Agricultural Research Station.
For primary bibliographic entry see Field 5B.
W91-06735

EFFECT OF HARVEST INTENSITY AND GROUND FLORA ESTABLISHMENT ON INORGANIC-N LEACHING FROM A SITKA SPRUCE PLANTATION IN NORTH WALES, UK.
Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
P. A. Stevens, and M. Hornung.
Biogeochemistry BIOGEP, Vol. 10, No. 1, p 53-65, 1990. 3 fig, 2 tab, 20 ref.

Descriptors: *Environmental impact, *Forestry, *Leaching, *Litter, *Nitrogen, *Soil chemistry, *Spruce trees, *Trees, *Wales, Agriculture, Biomass, Detritus, Nitrates, Soils, Vegetation.

Inorganic-N concentrations in soil solution of whole tree harvest (WTH) and conventional fell (CF) plots were monitored for two years before felling and four years after felling. Concentrations in the mineral soil after felling were higher than in standing forest for up to 14 months in both felling treatments. In the WTH plots inorganic-N concentrations then dropped steadily until four years after felling they approached zero. In contrast, inorganic-N concentrations of the CF plots remained comparatively large. Inorganic-N was dominated by nitrate throughout the period of the study, and especially in the mineral horizons. Felling debris was not a source of inorganic-N, unless indirectly through release and mineralization of soluble organic-N. Vegetation cover, biomass and N content were substantially greater in the WTH plots two to three years after felling, compared with the CF. Vegetation cover and brash (slash cover in N. America) were negatively correlated. There was also a negative correlation between inorganic-N concentration in soil water samplers and the vegetation cover within the collection area of, or a 1 m square surrounding, these samplers. Two factors are probably responsible for the reduction in inorganic-N concentrations after felling in the WTH: the rapid re-establishment of vegetation and the lack of a N source in felling debris. In the CF plots, brash prevents re-establishment of vegetation over wide areas for at least four years. However, brash is not directly a source of inorganic-N at this stage. (Author's abstract)
W91-06945

SEDIMENT BUDGETS.
For primary bibliographic entry see Field 2J.
W91-07057

CROPPING PATTERN AND ITS ROLE IN DETERMINING EROSION RISK: EXPERIMENTAL PLOT RESULTS FROM THE MUGELLO VALLEY (CENTRAL ITALY).
Florence Univ. (Italy). Dipt. di Scienze della Terra.
For primary bibliographic entry see Field 2J.
W91-07073

EROSION STUDIES IN SUME, A SEMIARID REGION IN THE NORTHEAST OF BRAZIL.
Universidade Federal da Paraiba, Campina Grande (Brazil). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W91-07091

MEASURING SEDIMENT YIELDS OF STORMS USING PSALT.
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
For primary bibliographic entry see Field 2J.
W91-07092

EVALUATION OF THE RISKS OF EROSION AND SEDIMENTATION IN BRAZIL FROM ROUGH SEDIMENT BUDGETS (EVALUATION DES RISQUES D'EROSION ET DE SEDIMENTATION AU BRESIL A PARTIR DE BILANS SEDIMENTOLOGIQUES RUDIMENTAIRES).
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
For primary bibliographic entry see Field 2J.
W91-07096

SEDIMENT YIELD IN THE VELHAS RIVER BASIN (MINAS GERAIS, BRAZIL).
ELETROBRAS, Rio de Janeiro (Brazil). Dept. de Recursos Energeticos.
For primary bibliographic entry see Field 2J.
W91-07097

CHANGES IN THE SEDIMENT OUTPUT OF TWO UPLAND DRAINAGE BASINS DURING FORESTRY LAND USE CHANGES.
Institute of Hydrology, Balquhidder, Lochearnhead, Scotland.
For primary bibliographic entry see Field 2J.
W91-07106

SEDIMENT YIELD AND AVAILABILITY FOR TWO RESERVOIR DRAINAGE BASINS IN CENTRAL LUZON, PHILIPPINES.
Hydraulics Research Ltd., Wallingford (England).

Overseas Development Unit.
For primary bibliographic entry see Field 2J.
W91-07116

4D. Watershed Protection

STRATEGIES FOR SUSTAINABLE AGRICULTURE IN THE TROPICS.
Florida Univ., Gainesville. Dept. of Geography.
For primary bibliographic entry see Field 3F.
W91-06108

USLE P FACTORS FOR SUBSURFACE DRAINAGE ON LOW SLOPES IN A HOT, HUMID CLIMATE.
Louisiana State Univ., Baton Rouge. Dept. of Agricultural Engineering.
R. L. Bengtson, and G. Sabbagh.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 4, p 480-482, July/August 1990. 5 tab, 10 ref.

Descriptors: *Erosion control, *Humid climates, *Louisiana, *Soil erosion, *Subsurface drainage, *Universal soil loss equation, Baton Rouge, Corn, Drainage, Monthly distribution, Precipitation, Rainfall, Runoff, Seasonal variation, Silage, Slopes, Soil types, Surface runoff, Temperature, Water table, Weather, Weeds.

Sediment losses were measured from a subsurface drainage-runoff-erosion experimental area near Baton Rouge, Louisiana, for the years 1981-1987. Subsurface drainage reduced soil loss 42%. An annual universal soil loss equation soil loss ratio of 0.11 for conventionally tilled silage corn was calculated for these plots. The first fall freeze killed the winter weeds and caused the potential for soil erosion to triple. The monthly P (support practice factor; 1.0 for up-and-down slope tillage) values varied from 0.37 to 0.94, with the highest value occurring during the summer and the lowest during the winter. An annual subsurface drainage P value of 0.60 was calculated from the soil erosion data. This annual P value applies to subsurface drainage for silage corn on low slopes under high rainfall that occurs throughout the year. The experiment also showed that subsurface drainage is more effective in reducing soil erosion during the winter by controlling water tables caused by the cool weather and large amounts of precipitation during this season in Louisiana. (Doria-PTT)
W91-06117

CROPPING AND TILLAGE OPTIONS TO ACHIEVE EROSION CONTROL GOALS AND MAXIMUM PROFIT ON IRREGULAR SLOPES.
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 2J.
W91-06233

COSTS AND BENEFITS OF THE CONSERVATION RESERVE PROGRAM.
Economic Research Service, Washington, DC. Commodity Economics Div.
C. E. Young, and C. T. Osborn.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 3, p 370-373, May/June 1990. 3 fig, 1 tab, 3 ref.

Descriptors: *Cost-benefit analysis, *Cropland, *Economic aspects, *Erosion control, *Land use, *Soil conservation, Administration, Administrative agencies, Conservation Reserve Program, Cultivated lands, Federal jurisdiction, Soil erosion.

The economic efficiency of the Conservation Reserve Program (CRP) was evaluated. The CRP is a voluntary, long-term cropland retirement program with a targeted enrollment of 40-45 million acres. In exchange for retiring cropland with highly erodible soils or other environmentally sensitive land for 10 years, the U.S. Department of Agriculture pays CRP participants (farm owners or operators) an annual per-acre rent and one-half the cost of establishing a permanent land cover. The CRP's primary goal is to reduce soil erosion on highly erodible cropland. Primary effects of the CRP are the following: changes in farm income; timber production; consumer costs; soil productivity; surface water quality, including filter strips; wildlife habitat; wind erosion; administrative costs; cost-sharing of vegetative cover; and technical assistance costs. CRP impacts were uniformly compared to a baseline situation characterized by the absence of CRP. Based upon estimates of the primary effects, the present value of net benefits for a 45 million acre CRP could range from $3.4 to $11.0 billion. (MacKeen-PTT)
W91-06273

SOIL EROSION STUDIES IN PERU.
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 4D.
W91-06277

SOIL EROSION STUDIES IN PERU.
North Carolina State Univ., Raleigh. Dept. of Soil Science.
J. C. Alegre, C. Felipe-Morales, and B. La Torre.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 3, p 417-420, May/June 1990. 1 fig, 9 tab, 7 ref.

Descriptors: *Agricultural practices, *Erosion control, *Soil conservation, *Soil erosion, Cover crops, Mulching, Peru, San Ramon, Santa Ana, Tillage, Wind erosion.

Because of its pronounced topography, much of Peru is sensitive to the erosive action of wind and water. The Coast is subject to wind erosion, and water erosion is dominant in the Sierra. Erosion also occurs in the High Selva when vegetation is cleared and in the Low Selva where high intensity rains fall on land farmed under slash-and-burn practices. Erosion research conducted at three sites in the Sierra and Selva regions (Santa Ana and two sites near San Ramon) indicates that use of cover crops and mulching conserve soil and water efficiently. Contoured rows present both advantages and disadvantages for erosion control, depending upon climatic conditions of the zone and degree of slope. (Author's abstract)
W91-06277

PERFORMANCE OF GULLY EROSION CONTROL MEASURES IN SOUTHEASTERN NIGERIA.
Nigeria Univ., Nsukka. Dept. of Geology.
C. O. Okagbue, and K. O. Uma.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 163-172, 5 fig, 1 tab, 8 ref.

Descriptors: *Erosion control, *Forest hydrology, *Gully erosion, *Nigeria, *Watershed management, Controlled drainage, Geologic control, Gullies, Permeability, Sediment control, Surface runoff.

The incidents of gullying in Nigeria, especially in southeastern regions, have caused much concern to successive governments and have generated much attention among institutional and private researchers. Studies, seminars, and workshops have been conducted to determine the immediate and remote causes of the gullies. Based on some of the results of these studies, a number of control measures have been designed and implemented in some of the affected areas. The performance of these control measures has been examined. The measures include tree planting, hydraulic regulation works that integrate a drainage network with storage ponds to cut off flood crests and lower hydraulic loads of interceptor canals, and stabilization works such as check dams on the main channels of gullies and wicker-work fences and hedges at the inner gully slopes. There is evidence that tree planting and surface regulation of surface waters is effective in controlling only shallow (<15 m deep) gullies that have not cut through a saturated zone. These measures tend to fail when used for deep gullies that are greatly affected by groundwater especially when such gully floors are located in noncohesive and very permeable sands. Design and construction of gully erosion control structures should be based, on the site-specific factors such as geology and hydrogeology, not on the general factors thought to be responsible for gully problems. (See also W91-06510) (Fish-PTT)
W91-06525

PRELIMINARY ASSESSMENT OF SOIL HYDRAULIC PROPERTIES, AND THEIR IMPLICATIONS FOR AGRO FORESTRY MANAGEMENT IN GRENADA, WEST INDIES.
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
For primary bibliographic entry see Field 2G.
W91-06549

DETERMINATION OF HYDROLOGICAL FLOW PATHS AND ASSOCIATED HYDROCHEMISTRY IN FORESTED CATCHMENTS IN CENTRAL SCOTLAND.
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 5B.
W91-06551

EROSION RESEARCH AND CONTROL IN JAPAN.
Kyoto Univ. (Japan). Faculty of Agriculture.
A. Takei.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 15-24.

Descriptors: *Disasters, *Erosion, *Erosion control, *Japan, *Soil erosion, Check dams, Dams, Economic aspects, Rainfall, Revegetation, Sediment yield, Sedimentation, Typhoons.

In Japan, intensive research on the phenomena of erosion and erosion control works for preventing or minimizing sediment disasters has been carried out in recent years. Sediment disasters occurred at a rate of about 600 per year from 1976 to 1985 and varied from 200 to 1200 events per year, resulting in 842 deaths. The Japanese government has invested about 450 billion yen every year during the 1980's to carry out public works for erosion control. Research in recent years has included fundamental studies in related fields such as geology, geophysics, geotechnics, hydraulics, biology, and others, to produce a generalized erosion control theory. Japan is situated in a region of heavy rainfall, is frequently hit by typhoons, and is also affected by locally concentrated torrential rainfall. Sediment disasters can only be controlled by controlling erosion at the source area. An artificial control work at the source area is the only effective means of decreasing the erosion rate and sediment yield from a watershed. A check dam in an unstable torrent is constructed to reduce the erosion potential by suppressing the torrent with sediment accumulated behind the dam. A vegetative cover may reduce erosion by protecting the soil surface and reinforcing the soil with a porous root network. Present and future research areas include debris flow, landslides, sediment transport and sediment yield, hazard maps, evacuation standards, and others. (See also W91-06570) (Brunone-PTT)
W91-06572

EFFECTS OF SLOPE LENGTH, SLOPE GRADIENT, TILLAGE METHODS AND CROPPING SYSTEMS ON RUNOFF AND SOIL EROSION ON A TROPICAL ALFISOL: PRELIMINARY RESULTS.
Ohio State Univ., Columbus. Dept. of Agronomy.
R. Lal.
IN: Sediment Budgets. IAHS Publication No. 174. International Association of Hydrological Sciences, Washington, DC. 1988. p 79-88, 6 tab, 21 ref.

Descriptors: *Agricultural practices, *Agricultural runoff, *Geomorphology, *Runoff, *Sediment erosion, *Sediment transport, *Slope effects, *Slopes,

*Soil erosion, *Tillage, Agricultural engineering, Catchment areas, Corn, Cropland, Land management, Nigeria, No-till cultivation, Runoff rates, Sediments, Tropical regions.

Effects of slope length on water runoff and erosion are not adequately understood. There have been few field experiments conducted specifically to quantify these effects. Field runoff plots of variable slope lengths and 4-m widths were established on a tropical Alfisol of about 7 to 9% slope at the International Institute of Tropical Agriculture, Ibadan, Nigeria. There were six slope lengths varying from 10 to 60 m with 10-m increments. An additional plot 25 m long was established to study the soil erodibility factor. There were two tillage methods: plowing and the no-till system of seedbed preparation. Corn (Zea mays) was sown in the first season and cowpea (Vigna unguiculata) in the second season. It was found that runoff and erosion were significantly influenced by tillage methods and slope length. For plowed plots, slope length had a negligible effect on runoff per unit area. In contrast, however, erosion from plowed plots increased as a power function of slope length and slope length parameters. In no-till treatments, both runoff and soil erosion decreased linearly or inversely with increase in slope length. This differential response due to tillage methods may be attributed to the variable effects of slope length, crop residue mulch, and tillage methods on time of concentration and runoff velocity. (See also W91-07057) (Author's abstract)
W91-07066

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SELF-PROTECTION OF ESCHERICHIA COLI IN SEAWATER.
Clyde River Purification Board, East Kilbride (Scotland).
J. S. Findley, J. C. Curran, D. P. Milne, J. M. Crowther, and S. G. Wallis.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 451-456, October 1990. 4 fig, 24 ref.

Descriptors: *Bioindicators, *Enteric bacteria, *Escherichia coli, *Seawater, Bacterial analysis, In vitro tests, Laboratory methods, Temperature effects, Water pollution.

Controlled laboratory experiments, epifluorescence microscopy and Coulter counter analyses were used to examine and elucidate the inactivation mechanisms for the enteric bacterium Escherichia coli. The survival of E. coli was found to be enhanced with increasing initial cell concentration in the absence of any suspended solids. At 20 degrees C, the formation of a bacterial aggregate may have created an inner core of cells protected from excessive osmotic stress by an outer coating of cells loosely attached by polymers or cations. At 10 degrees C, however, the self-protection mechanism is not as pronounced, due to lower temperatures favoring greater bacterial survival and affording a less hostile environment to which bacteria can adapt without the need of a self-protection mechanism. (Author's abstract)
W91-05972

ASSESSING ATRAZINE PERSISTENCE IN SOIL FOLLOWING A SEVERE DROUGHT.
Michigan State Univ., East Lansing. Pesticide Research Center.
R. A. Leavitt, J. J. Kells, J. R. Bunkelmann, and R. M. Hollingworth.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 22-29, January 1991. 2 fig, 2 tab, 18 ref.

Descriptors: *Analytical methods, *Atrazine, *Drought effects, *Herbicides, *Immunoassay, *Michigan, *Pollutant identification, *Soil analysis, Cation exchange, Crop production, Gas liquid chromatography, Hydrogen ion concentration, Soil organic matter, Triazine pesticides.

Atrazine residue levels in Michigan soils following the 1988 drought and the suitability of the immunoassay technique over a wide variety of soils were studied using samples obtained from 30 counties in November and December. The drought created a critical need for an assessment of atrazine concentration in soil to advise producers on crop management options related to atrazine sensitive crops. Laboratory analysis of this compound included gas liquid chromatography (GLC) and recently developed immunoassay techniques. Soil characterization tests for pH, organic matter, and cation exchange capacity were conducted by the Michigan State University Soil Testing Laboratory. In general, both the immunoassay and Soxhlet-GLC techniques provided adequate estimates of atrazine residue levels in soil for making decisions on rotational crop selection. The immunoassay technique detected approximately 20% less atrazine in soil, probably due to differences in initial extraction efficiency. The immunoassay technique examined in this study is inexpensive, provides quick results and is relatively easy to use. It accurately detected atrazine at concentrations as low as 0.01 ppm indicating that this technique is a reasonable alternative to the traditional Soxhlet-GLC procedure for atrazine analysis in soil in situations where maximum precision in analysis is not critical and could be used to assay s-triazine residues under field conditions. (Medina-PTT)
W91-05985

ENZYME IMMUNOASSAY FOR THE DETERMINATION OF ATRAZINE RESIDUE IN SOIL.
California Dept. of Food and Agriculture, Sacramento. Environmental Hazards Assessment Program.
K. S. Goh, J. Hernandez, S. J. Powell, C. Garretson, and J. Troiano.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 30-36, January 1991. 2 fig, 3 tab, 9 ref.

Descriptors: *Analytical methods, *Atrazine, *California, *Enzyme immunoassay, *Gas chromatography, *Groundwater pollution, *Herbicides, *Immunoassay, *Pollutant identification, *Soil analysis, Correlation analysis, Detection limits, Drinking water, Extraction efficiency, Mathematical models, Methanol, Path of pollutants, Solvent extraction, Triazine pesticides.

The presence and transport of atrazine in water and soil are being monitored and researched by the California Department of Food and Agriculture due to concerns of groundwater contamination and its potential adverse health impacts from drinking contaminated water. A commercially available enzyme immunoassay (EIA) kit was optimized and evaluated to quantify atrazine residues in soil by (1) determining the variability of the calibration line through time, (2) comparing the extraction efficiency of water, methanol, methanol + water, and acetonitrile, and (3) quantifying atrazine concentration in field soil samples using the EIA and comparing the results to gas chromatographic (GC) analysis. Results of these experiments indicated that calibration lines produced on different days had different intercepts, but similar slopes and goodness of fits. However, slopes were different between standard sets, but intercepts were similar. The extraction efficiency for the four solvents depended on the concentration of atrazine. Results for the methanol or methanol + water extraction were more consistent than for water or acetonitrile extraction. Therefore, methanol + water was selected as the solvent for subsequent field sample extractions. The theoretical detectable range of atrazine in soil using the EIA kit was 0.5-2000 ppb. Although the extraction efficiency were dissimilar for the EIA kit and GC, the atrazine concentrations in split samples (48 pairs) as determined by immunoassay and GC were highly correlated. (Medina-PTT)
W91-05986

TOXICITY TEST WITH ALGAE: A DISCUSSION ON THE BATCH METHOD.
National Swedish Environment Protection Board, Solna.
E. Hoernstroem.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 343-353, December 1990. 2 fig, 2 tab, 22 ref.

Descriptors: *Algae, *Analytical methods, *Bioassay, *Bioindicators, *Culturing techniques, *Reviews, *Toxicity, *Toxicology, Environmental quality, Oligotrophic lakes, Phytoplankton, Sweden, Testing procedures.

Different aspects of the so-called batch method of toxicity testing with phytoplankton--ranging from the test organism to the reporting of results--are reviewed, together with recommendations for improved technology. Limitations of this system and the importance of the test organism have led to consideration of a simpler algal test based on a limited number of species best suited to the local conditions prevailing in oligotrophic Swedish lakes. Data obtained locally imply that the sensitivity of currently-available standard toxicity tests may be restricted. Therefore, they must be complemented by a test adapted to Scandinavian water quality. There are strong indications that the relatively simple technology of traditional batch toxicity tests should be retained. The main problem seems to be the selection of a test species. Continued testing of different chemicals should be done on a larger number of selected phytoplankton and the results should be compared with other tests, mainly fish tests, since the results from such tests are probably more relevant to environmental conditions than are algal tests. It should be possible to create a permanent algal test battery for continuous routine tests with at least one of the species regularly included in the sensitive category. (Medina-PTT)
W91-06002

UPTAKE AND BODY DISTRIBUTION OF CHLORINATED PHENOLICS IN THE FRESHWATER MUSSEL, ANODONTA ANATINA L.
Joensuu Univ. (Finland). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W91-06003

HETEROTROPHIC PLATE COUNTS AND THE ISOLATION OF BACTERIA FROM MINERAL WATERS ON SELECTIVE AND ENRICHMENT MEDIA.
Coimbra Univ. (Portugal). Dept. de Zoologia.
C. M. Manaia, O. C. Nunes, P. V. Morais, and M. S. Da Costa.
Journal of Applied Bacteriology JABAA4, Vol. 69, No. 6, p 871-876, December 1990. 3 tab, 21 ref. JNICT (43/INF/87).

Descriptors: *Bacterial analysis, *Bottled water, *Culturing techniques, *Drinking water, *Heterotrophic bacteria, *Mineral water, *Pollutant identification, *Water analysis, Bacterial growth, Coliforms, Contamination, Culture media, Gram-negative bacteria.

Heterotrophic plate counts of 15 brands of bottled non-carbonated mineral waters were examined and showed generally high and variable bacterial contents. Four selective or enrichment media for the enumeration of coliforms (m-Endo LES and m-lauryl sulfate agar) and Pseudomonas aeruginosa (cetrimide-nalidixic acid agar and malachite green broth) were used to isolate several species of Gram-negative bacteria. Strains identified as CDC gr IVc-2 and Comamonas (Pseudomonas) acidovorans were the two most commonly isolated bacteria. Considerable variation was observed between the brands, and between two batches of the same mineral water. Bottled non-carbonated mineral waters generally have high heterotrophic plate counts, since the elimination of microorganisms by disinfection or sterilization is not permitted. These high numbers of heterotrophic bacteria are considered to be the result of a natural biological process resulting primarily from the multiplication of those bacteria that were present in low numbers in the source water, although sometimes contamination

within the bottling plant may be responsible. (Medina-PTT)
W91-06005

FIELD CALIBRATION OF SURFACE: A MODEL OF AGRICULTURAL CHEMICALS IN SURFACE WATERS.
Monsanto Agricultural Co., St. Louis, MO.
D. A. Gustafson.
Journal of Environmental Science and Health (B) JPFCD2, Vol. 25, No. 5, p 665-687, 1990. 5 fig, 5 tab, 5 ref.

Descriptors: *Agricultural chemicals, *Herbicides, *Hydrologic models, *Model studies, *Path of pollutants, Agricultural watersheds, Alachlor, Algorithms, Atrazine, Cyanazine, Metolachlor, Model testing, Runoff forecasting, Surface water.

Agricultural chemicals sporadically occur at detectable levels in the surface waters of intensively farmed watersheds. HSPF (Hydrologic Simulation Program--Fortran), a previously released model of agricultural chemicals in surface water, had been used to predict concentrations which were much higher (10 x) than those actually observed during monitoring studies. A new model, SURFACE, is described here which is much simpler than HSPF and gives better predictions of surface water concentrations. SURFACE uses PRZM (Pesticide Root Zone Model), an EPA model, to calculate edge-of-field runoff losses and simple hydraulic routing algorithms to determine concentrations at the bottom of large river basins. Calibration was performed by forcing agreement between SURFACE model predictions and concentrations of alachlor, atrazine, cyanazine, and metolachlor found during a 1985 surface-water survey. Preliminary validation was performed by comparing predictions of the model with 1986 monitoring results for the same four chemicals. In the water systems sampled during 1985 and 1986, SURFACE predictions of annualized mean concentrations for alachlor, atrazine, cyanazine and metolachlor were within 0.09 ppb half of the time. (Medina-PTT)
W91-06007

EXPLANATION FOR THE DECLINE OF BACTERIA INTRODUCED INTO LAKE WATER.
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
For primary bibliographic entry see Field 5B.
W91-06023

EPIDEMIOLOGICAL STUDY OF BEACH WATER POLLUTION AND HEALTH-RELATED BATHING WATER STANDARDS IN HONG KONG.
Hong Kong Environmental Protection Dept., Wan Chai.
W. H. S. Cheung, R. P. S. Hung, K. C. K. Chang, and J. W. L. Kleevens.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 243-252, 1991. 1 fig, 7 tab, 15 ref.

Descriptors: *Epidemiology, *Escherichia coli, *Hong Kong, *Public health, *Staphylococcus, *Swimming, *Water quality standards, Bacteria, Marine pollution, Pathogens, Statistical studies, Water pollution effects.

A prospective epidemiological study was undertaken in Hong Kong in 1987, in which 18,741 usable responses were obtained. It showed bathing in the coastal beaches of Hong Kong poses an increased risk of developing gastrointestinal, ear, eye, skin, respiratory and total illness. Swimmers immersed in the more polluted beach waters are exposed to a significantly higher risk of contracting swimming-associated gastrointestinal, skin, respiratory and total illness. E. coli was found to be the best indicator for swimming-associated gastroenteritis and skin symptoms among the bathers, and a linear relationship could be established. Staphylococci was a good indicator for ear, respiratory and total illness, and should be used in conjunction with E. coli. Beach water quality objectives for both E. coli and Staphylococci have been proposed. A four-tier classification system (rather than a single acceptability criterion), based upon swimming-associated health risks, has been developed for the beaches of Hong Kong. Information on the bacterial water quality and health risk levels of individual beaches is reported to the public both annually and fortnightly, so that beach-goers can choose where to go for swimming based upon health effects data. (Author's abstract)
W91-06066

DETECTION OF HUMAN ROTAVIRUSES IN FRESH AND ESTUARINE WATERS BY DOT-BLOT HYBRIDIZATION.
Hebrew Univ. of Jerusalem (Israel). Div. of Environmental Sciences.
A. M. Nasser, M. K. Estes, and T. G. Metcalf.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 253-260, 1991. 4 fig, 2 tab, 15 ref.

Descriptors: *Deoxyribonucleic acid, *Epidemiology, *Rotaviruses, *Statistical studies, Dot-blot hybridization, Estuaries, Laboratory procedures, Marine pollution, Pathogens.

A study was conducted to evaluate the suitability of dot-blot hybridization for detecting rotavirus in fresh and estuarine water samples, using cloned DNA of genome segment 6 of human strain Wa and simian SA-11 rotaviruses. Probes of Wa and SA-11 cross-hybridized with heterologous RNAs of SA-11 and Wa rotaviruses under low stringency conditions. Cross-hybridization reactions were minimized or eliminated under high stringency conditions, while homologous reactions were not affected. The Wa probe did not react with representatives of the major enterovirus groups or hepatitis A virus. Hybridization detection sensitivity was not affected by organic material present in waters or proteinaceous material of eluents. Hybridization using cDNA of Wa rotavirus was found to be more sensitive than either Rotazyme enzyme immunosorbent assay (ELISA) or electron microscopy for detecting rotavirus in stool specimens. Dot-blot hybridization using cDNA of genome segment 6 of Wa rotavirus was found to more sensitive than solid-phase radioimmunoassay (SPIRA) for detecting rotavirus in estuarine and fresh water samples. Only 9 out of 54 (18.5%) estuarine and fresh water samples were positive by SPRIA, whereas dot-blot hybridization with Wa probe resulted in 21 out of 54 (38.8%) positive samples. One out of 20 stool samples and 23 out of 54 (44.6%) estuarine and fresh water samples were found to be positive by a pBR-322 plasmid probe. These results indicate that pBR-322 and related plasmids are present in high frequency in fecally polluted waters. Although different numbers of positive results were found with Wa and pBR-322 probes, more research is required to ascertain that hybridization reactions with such plasmids do not occur when using cDNA rotavirus probes. (Author's abstract)
W91-06067

LINEAR ALKYLBENZENES (LABS) IN URBAN RIVERINE AND COASTAL SEDIMENTS AND THEIR USEFULNESS AS A MOLECULAR INDICATOR OF DOMESTIC WASTES.
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Environmental Science and Conservation.
For primary bibliographic entry see Field 5B.
W91-06087

ENVIRONMENTAL TRANSFORMATION, PHOTOLYSIS OF FLUORESCING PETROLEUM COMPOUNDS IN MARINE WATERS.
Kuwait Inst. for Scientific Research, Safat. Environmental and Earth Sciences Div.
P. Literathy, G. Morel, and A. Al-Bloushi.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 507-516, 1991. 7 fig, 2 tab, 12 ref.

Descriptors: *Degradation, *Fate of pollutants, *Fluorescence, *Marine pollution, *Oil pollution, *Photolysis, *Pollutant identification, *Polycyclic aromatic hydrocarbons, *Ultraviolet radiation, Benzopyrene, Carcinogens, Oil characterization, Photochemistry, Spectroscopy.

A great variety of fluorescing compounds--mainly polycyclic aromatic hydrocarbons (PAHs) which are of concern in environmental and public health risk assessment due to their carcinogenic properties--exists in petroleum as complex mixtures in petroleum, which makes separation and identification of individual species difficult, if not impossible. Ultraviolet (UV) fluorescence spectroscopy offers a relatively simple way to characterize and quantify these compounds in environmental samples. PAHs are known to be sensitive to photochemical reactions rather than to biological oxidation. Several studies carried out with pure PAH compounds demonstrated their fast photolysis and half-lives of a few minutes to a few hours, depending upon the irradiation light flux. Crude oil and benzo(a)pyrene (BaP) were used as model mixture of fluorescing compounds in seawater. Solar irradiation conditions were selected to characterize maximum photolysis rates at 29 degrees north latitude. In addition to the characteristics of the irradiation light, reactor geometry, level of dispersion of the petroleum compounds and the presence of particulate matter influenced significantly the reaction rate coefficients. Photolysis of BaP was described with a first-order rate coefficient, whereas photolysis of the other compounds, quantified by fluorescence intensity at different wavelengths, was characterized with a multicomponent equation. BaP can be considered as an internal actinometer in photolysis experiments with PAH mixtures. The level of dispersion affected the photolysis rates, which were highest in the dissolved and chemically dispersed samples. Ratios between fluorescence intensities at different wavelengths allowed comparison with the characteristics of actual environmental samples, providing additional information on their weathering history. (Author's abstract)
W91-06094

BIOMARKERS OF ENVIRONMENTAL CONTAMINATION.
Lewis Publishers, Chelsea, Michigan. 1990. 457p. Edited by John F. McCarthy and Lee R. Shugart.

Descriptors: *Bioindicators, *Environmental protection, *Monitoring, *Pollutant identification, *Water pollution effects, Anatomy, Cytology, Ecotoxicology, Field tests, Genetics, Immunology, Metabolism, Metals, Physiology, Toxicity, Water quality.

Biological markers are measurements at the molecular, biochemical, or cellular level in either wild populations from contaminated habitats or in organisms experimentally exposed to pollutants that indicate that the organism has been exposed to toxic chemicals, and the magnitude of the organism's response to the contaminant. Biological markers measured in wild animals can directly contribute to detecting, quantifying, and understanding the significance of exposure to chemicals in the environment. These measurements in environmental species may also help assess the potential for human exposure to environmental pollutants, and for predicting the human health risks. It is the objective of this volume to review the current state of science as it pertains to the scientific basis, current state of development, validation, and use of biological markers (biomarkers) in environmental research. The emphasis is on identifying and evaluating exposure of environmental species and effects on the health of environmental species and the integrity of their ecosystem. The various chapters describe different types of biomarkers that offer promise for environmental monitoring. The biomarkers are arranged in categories defined by the nature of the toxic endpoint being probed: anatomical and cytological endpoints; detoxication, adaptive and immunological responses; genotoxic responses; metal metabolism; and application of biomarkers in field evaluation. (See W91-06177 thru W91-06193) (Lantz-PTT)
W91-06176

LIVER STRUCTURAL ALTERATIONS ACCOMPANYING CHRONIC TOXICITY IN FISHES: POTENTIAL BIOMARKERS OF EXPOSURE.
California Univ., Davis. School of Veterinary Medicine.

D. E. Hinton, and D. J. Lauren.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 17-57, 20 fig, 2 tab, 109 ref. U.S.P.H.S. Grants CA45131 and ESO4699.

Descriptors: *Bioindicators, *Fish physiology, *Liver, *Toxicity, *Water pollution effects, Cancer, Chronic toxicity, Ecotoxicology, Lesions, Metabolism.

Fish liver microscopic structure is an integrator of physiological and biochemical function which, when altered, may produce biomarkers of prior exposure to toxicants. The liver has a key role in xenobiotic metabolism and excretion, digestion and storage, and production of yolk protein. Thus, alterations in structure are expected under certain toxic conditions. A series of lesions associated with chronic liver toxicity are described, illustrated, and evaluated for their potential usefulness as biomarkers of toxicant exposure. Where possible, the potentially confounding morphological changes associated with infectious disease, season, sex, and nutritional state are differentiated from toxicant-induced lesions. Hepatocyte coagulative necrosis, hepatocyte regenerative foci, spongiosis hepatitis, and neoplasia appear to be the most promising liver structural biomarkers of prior exposure to toxicants. (See also W91-06176) (Author's abstract)
W91-06177

HISTOPATHOLOGY OF ATLANTIC TOMCOD: A POSSIBLE MONITOR OF XENOBIOTICS IN NORTHEAST TIDAL RIVERS AND ESTUARIES.
Louisville Univ., KY. Dept. of Biology.
S. M. Cormier, and R. N. Racine.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 59-71, 4 fig, 4 tab, 15 ref.

Descriptors: *Atlantic tomcod, *Bioindicators, *Hudson River, *Pawcatuck River, *Saco River, *Water pollution effects, Cancer, Ecotoxicology, Fish physiology, Lipids, Liver, Toxicity.

Atlantic tomcod, Microgadus tomcod, from the Hudson River, New York, exhibited a very high incidence of hepatocellular carcinoma while less industrially impacted rivers such as the Pawcatuck River, Rhode Island and the Saco River, Maine were much lower. A comparative pathological study revealed that hepatic function was compromised by fatty infiltration, basophilic foci, areas of cellular alteration, and hepatocellular carcinoma in samples from Hudson River fish. Age and size may also be affected in Hudson River tomcod. An etiology involving xenobiotics is highly suspect for these effects since it is known that elevated detoxification of some organics results in increased hepatic lipid levels. Juvenile tomcod removed from the Hudson after six months and reared in clean water showed no incidence of liver disease six months later. (See also W91-06176) (Author's abstract)
W91-06178

CROAKER (NIBEA MITSUKURII) AND THE SEA CATFISH (PLOTOSUS ANGUILLARIS): USEFUL BIOMARKERS OF COASTAL POLLUTION.
Shizuoka Univ. (Japan). Lab. of Food Hygiene.
M. Yamashita, N. Kinae, I. Kimura, H. Ishida, and H. Kumai.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 73-84, 4 fig, 5 tab, 14 ref.

Descriptors: *Bioindicators, *Catfish, *Coastal waters, *Croakers, *Monitoring, *Wastewater pollution, *Water pollution effects, Cancer, Ecotoxicology, Estuaries, Fish physiology, Industrial wastewater, Mutagens, Organic compounds, Pulp and paper industry, Toxicity.

During the course of epizootiological surveys on neoplasms in coastal fish on the Japanese islands of Honshu, Shikoku, and Kyushu, an estuarine area (station A) was unique in the high incidence of chromatophoroma in the croaker, Nibea mitsukurii, and of skin pigment cell hyperplasia in the sea catfish, Plotosus anguillaris. The following results suggest that the pigment cell disorders in these species may be useful biomarkers to monitor coastal water pollution by carcinogens: (1) the skin lesions in both species were induced by administration of certain kinds of known carcinogens; (2) the effluents from a kraft pulp mill located near station A contained mutagenic substances; (3) the effluents induced skin pigment cell hyperplasia on 70 to 100% of tank reared sea catfish; and (4) four chloroacetones and three alpha-dicarbonyl compounds were detected from effluents as mutagens by gas chromatography/mass spectrometry analysis. (See also W91-06176) (Author's abstract)
W91-06179

SUBLETHAL RESPONSES OF PLATICHTHYS STELLATUS TO ORGANIC CONTAMINATION IN SAN FRANCISCO BAY WITH EMPHASIS ON REPRODUCTION.
Lawrence Livermore National Lab., CA. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W91-06180

HEPATIC ENZYMES AS BIOMARKERS: INTERPRETING THE EFFECTS OF ENVIRONMENTAL, PHYSIOLOGICAL AND TOXICOLOGICAL VARIABLES.
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. D. Jimenez, A. Oikari, S. M. Adams, D. E. Hinton, and J. F. McCarthy.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 123-142, 6 fig, 2 tab, 41 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Bioindicators, *Enzymes, *Fish physiology, *Liver, *Toxicity, *Water pollution effects, Benz(a)pyrene, Cytochromes, Industrial wastewater, Monitoring, Organic compounds, Seasonal variation, Spawning, Tennessee, Water quality.

Components of the hepatic mixed function oxidase (MFO) system were evaluated as biomarkers of contaminant exposure in fish from streams in Tennessee. The responses of several MFO components (ethoxyresorufin-O-deethylase (EROD) activity, cytochrome P-450 levels, and NADPH cytochrome c reductase activity) were comparable in fish from four pristine reference streams; EROD activity and cytochrome P-450 levels did vary over the year, with highest levels apparent in the autumn. Levels were lower in reproductively active females than in males during the same season. Fish from a stream impacted by an industrial effluent had EROD activities that were significantly higher than those from the reference stream, although the differences were greater in males during the warmer months. Reproductively active females from the contaminated stream also had higher EROD activity, but their enzyme activity was considerably lower than in males tested during the same season. Fish from the most severely impacted site did not have the highest EROD levels, possibly due to hepatotoxic damage to the liver. Laboratory exposure of fish to a hepatotoxin reduced the capacity of the liver to respond in the fish. This was an informative biomarker of exposure, but the role of environmental, physiological, and toxicological factors on MFO response must be understood in order to properly interpret the biomarker response. (See also W91-06176) (Author's abstract)
W91-06181

MACROPHAGE RESPONSES OF ESTUARINE FISH AS BIOINDICATORS OF TOXIC CONTAMINATION.
Virginia Inst. of Marine Science, Gloucester Point.
B. A. Weeks, R. J. Huggett, J. E. Warinner, and E. S. Mathews.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 193-201, 1 fig, 3 tab, 21 ref.

Descriptors: *Bioindicators, *Estuaries, *Fish physiology, *Macrophages, *Toxicity, *Water pollution effects, Biochemistry, Chesapeake Bay, Ecotoxicology, Elizabeth River, Immunology, Kidneys, Polycyclic aromatic hydrocarbons, Sediments, Tributyltin, Virginia, Water quality.

Fish exposed to toxic pollutants both in the wild and in the laboratory show significant changes in the immune activity of kidney macrophages. Decreases in the chemotactic and phagocytic responses, and increases in neutral red uptake and melanin accumulation were observed in several species of fish captured in the Elizabeth River, Virginia, a tributary of the Chesapeake Bay, which is highly contaminated with polynuclear aromatic hydrocarbons (PAHs). The chemiluminescent response of macrophages was inhibited by laboratory exposure of the fish to toxic sediments, and by in vitro exposure of macrophages to tributyltin (TBT). The phagocytic activity of macrophages from the Elizabeth River spot and hogchoker returned to normal after the fish were held in clean water for 3 weeks, indicating that the decreased activity was related to exposure to Elizabeth River pollutants but may be reversible. Since sediments from the Elizabeth River contain high levels of PAHs, it is possible that these chemicals are responsible for the observed immunomodulation. Further research will be required to determine the causative agent(s) of impaired immune function and the mechanism of the toxic effect. In addition, the effects of age, nutritional status, and other waterborne contaminants remain to be determined. It is proposed that these assays can serve as useful biomarkers of the immune status of fish, and that careful choice of method and interpretation of results can give important information for evaluating the health of fish exposed to environmental contamination. (See also W91-06176) (Lantz-PTT)
W91-06182

BIOLOGICAL MONITORING: TESTING FOR GENOTOXICITY.
Oak Ridge National Lab., TN. Environmental Sciences Div.
L. R. Shugart.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 205-216, 2 fig, 2 tab, 46 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Bioindicators, *Genotoxicity, *Toxicity, *Water pollution effects, Cancer, Carcinogenicity, DNA, Ecotoxicology, Physiological effects, Water quality.

Biological monitoring is an approach of considerable interest to scientists investigating the effects of hazardous substances in the environment. Responses in living organisms, usually detected at the molecular level, were evaluated for their potential to identify exposure to dangerous substances and to define or to predict subsequent deleterious effects. DNA damage has been proposed as a useful biomarker for assessing the genotoxic properties of environmental contaminants. Many of these substances are chemical carcinogens and mutagens with the capacity to cause various types of DNA damage. Genotoxic chemicals may form stable adducts with DNA or cause strand breaks. Additional damage may occur through the inhibition of normal DNA repair. Each type of damage may contribute toward the eventual transformation of the cell. Environmental genotoxicity may be feasible by monitoring DNA damage in an organism as a biomarker--by detecting and quantifying changes in DNA. If biological monitoring is to become a viable scientific tool for such areas as environmental research, then continued effort and emphasis must be placed on: (1) research concerned with those basic mechanisms by which substances elicit their responses in a living organism; (2) development of new analytical techniques; and (3) interpretation of data from field studies. (See also W91-06176) (Lantz-PTT)
W91-06183

METAL-BINDING PROTEINS AND PEPTIDES FOR THE DETECTION OF HEAVY METALS IN AQUATIC ORGANISMS.
Wisconsin Univ.-Milwaukee. Dept. of Chemistry.

D. H. Petering, M. Goodrich, W. Hodgman, S. Krezoski, and D. Weber.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 239-354, 3 fig, 3 tab, 78 ref. NIH Grants ES-04026 and ES-04184.

Descriptors: *Bioindicators, *Heavy metals, *Literature review, *Peptides, *Proteins, *Water pollution effects, Ecotoxicology, Metallothioneins, Monitoring, Toxicity.

Mammalian organisms exposed to elevated levels of a number of metals including Cd, Hg, Zn, and Cu, respond with the de novo synthesis of hepatic and renal metallothionein (MT), which then chelates most of the extra metal entering the tissue. Because of the prominence of metallothionein in studies of heavy metal toxicity, attention has been drawn to its possible use as a biomarker for heavy metal exposure in the environment. Evaluation of this proposal will require field work, which is guided by an understanding of the complexities of metallothionein biochemistry and chemistry and by the recognition that other metal binding structures may be of interest as well. The objective of this review article is to provide a selective summary and analysis of the information in the literature on mammalian metallothionein and laboratory results on aquatic systems. It is shown that before such determinations gain meaning, one must know whether measured levels of binding protein represent: basal concentrations, induction of protein after exposure to metals, host response to stress, or a complex combination of these. Finally, it is concluded that if metallothionein-like structures are to serve as biomarkers in aquatic systems, much more direct study of specific aquatic organisms will be needed. (See also W91-06176) (Lantz-PTT)
W91-06186

METALLOTHIONEIN AS A BIOMARKER OF ENVIRONMENTAL METAL CONTAMINATION: SPECIES-DEPENDENT EFFECTS.

Mississippi Univ., University. Dept. of Pharmacology.
W. H. Benson, K. N. Baer, and C. F. Watson.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 255-265, 3 fig, 4 tab, 29 ref.

Descriptors: *Bioindicators, *Fish physiology, *Heavy metals, *Metallothioneins, *Water pollution effects, Copper, Ecotoxicology, Gills, Liver, Proteins, Stress, Toxicity, Zinc.

The metal-binding protein, metallothionein (MT), is induced by selected heavy metals and has appeared promising as a biological marker of metal exposure. In mammals, a variety of stresses have been demonstrated to induce MT-like protein synthesis in the liver. Exposure to a variety of stresses in teleosts, however, has failed to induce hepatic MT-like protein synthesis. Significant alterations in Zn and Cu content were observed in the gill MT-like protein fraction as a result of environmental stress exposure. This response appears to be unique to the gill, since the hepatic MT-like protein metal content was not significantly altered by environmental stresses. The significance of the decreased Zn MT-like protein content in gill during stress exposure is not apparent. Zn may be released from this fraction as a result of increased metabolic demand during stress. Zn deficiency, Zn, as well as Cu have been demonstrated to decrease in the Mt-like protein fraction of mammals. The hepatic Zn content of MT-like proteins in teleosts has been demonstrated to be released during periods of high metabolic demand such as sexual maturation. Metal content of gill MT-like protein may be involved in an adaptive response to stress. Gill MT-like proteins appear to be influenced by environmental stresses to a greater extent than hepatic MT-like proteins. Environmental stresses may confound the use of gill MT-like proteins for monitoring metal exposure. The liver MT-like protein appears to be more metal specific and may be promising as a biomarker of environmental metal contamination. Physiological conditions such as sexual maturation and nutritional status may, however, alter the metal content of hepatic MT-like proteins. Therefore, caution should be taken when evaluating hepatic MT-like proteins in relation to metal exposure. (See also W91-06176) (Lantz-PTT)
W91-06187

METALLOTHIONEIN: A POTENTIAL BIOMONITOR OF EXPOSURE TO ENVIRONMENTAL TOXINS.

California Inst. of Tech., Pasadena. Div. of Biology.
J. S. Garvey.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 267-287, 9 fig, 2 tab, 91 ref. NIH Grant ESO1629.

Descriptors: *Bioindicators, *Literature review, *Metallothioneins, *Water pollution effects, Copper, Ecotoxicology, Heavy metals, Monitoring, Zinc.

The metal-binding protein, metallothionein (MT), is a potential biomonitor for the assessment of exposure of animals, including feral species, to environmental toxins and to stress. MT is ubiquitous and is induced not only by Zn and Cu but by numerous metals which may be associated with environmental pollution. As indicated in this review article, the radioimmunoassay and enzyme immunosorbent assay developed for detection and quantitation of MT have a well-documented utility in performing this assessment in the case of all mammalian isoforms studied to date. To extend the field of investigation to non-mammalian species, including microorganisms, it is necessary to develop antibodies specific for MTs from species of interest. MTs or candidate metal-binding proteins have been assayed in trout, oysters, mussels, crabs, plaice, and scallops. A first step in this regard is to identify sentinel species, particularly feral species of both aquatic and terrestrial habitat. A second step is to select from sentinel species a prototypic species that will allow limiting the number of antibody reagents produced by virtue of isoform homology in principal antigenic determinants. MT can serve as the biomonitor for all mammals, and perhaps for all other vertebrates and invertebrates, and for some microorganisms. For plants it is conceivable that phytochelatins (phytometallothioneins) may serve as the biomonitor. (See also W91-06176) (Lantz-PTT)
W91-06188

SENTINEL SPECIES AND SENTINEL BIOASSAY.

Missouri Univ.-Columbia. Environmental Trace Substances Research Center.
W. R. Lower, and R. J. Kendall.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 309-331, 162 ref.

Descriptors: *Bioassay, *Bioindicators, *Literature review, *Water pollution effects, Biological studies, Ecotoxicology, Monitoring, Sentinel species, Toxicity.

Assessment of the toxic effects of environmental contamination and the development of biological early warning systems for appraisal of these toxic effects can be advanced by the use of sentinel species and sentinel bioassays. A sentinel species can be defined as any domestic or wild microorganism, plant or animal, that can be used as an indicator of exposure to and toxicity of a xenobiotic that can be used in assessing the impact on human and/or environmental health because of the organism's sensitivity, position in a community, likelihood of exposure, and geographic and ecological distribution or abundance. A sentinel species can be any organism or tissue of an organism that fulfills the need as a suitable subject upon which to perform bioassay and chemical analysis. The selection of organisms and changes in biological functions as sentinels can be made from currently used species and bioassays. In addition, an effort can be made to 'plan' a species and 'plan' a bioassay by developing a list of desired characteristics for both, discuss these with knowledgeable colleagues and, in a purposeful manner, come up with a best-effort combination which will accomplish the desired biological monitoring. Fish have been used as indicators of environmental contamination, including fish from the Great Lakes, from Torch Lake, Michigan, from wastewater treatment ponds in Alabama, and from the Fox River in Illinois. Marine fish from Puget Sound, the Hudson River, and Boston Harbor have also been used as bioindicators. (See also W91-06176) (Lantz-PTT)
W91-06190

APPLICATION OF BIOINDICATORS IN ASSESSING THE HEALTH OF FISH POPULATIONS EXPERIENCING CONTAMINANT STRESS.

Oak Ridge National Lab., TN. Environmental Sciences Div.
S. M. Adams, L. R. Shugart, G. R. Southworth, and D. E. Hinton.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 333-353, 6 fig, 2 tab, 52 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Bioindicators, *Fish, *Toxicity, *Water pollution effects, DNA, Ecotoxicology, Enzymes, Fish physiology, Histology, Lipids, Organic compounds, Polychlorinated biphenyls, Polycyclic aromatic hydrocarbons, RNA, Water quality.

Assessment of the response of fish populations to contaminants usually involves measurement of indicators of exposure or effects, but rarely do biomonitoring studies incorporate a mixture of endpoints that include both types of indicators. The integrated bioindicator approach involves monitoring a suite of selected exposure and effects indicators at several levels of biological organization from the biomolecular level to the community level through: lipid analysis, serum chemistry, detoxification enzymes, DNA integrity, histopathology, and RNA/DNA analysis. Measurement of these biological variables permits the early detection of environmental problems and provides insights into causal relationships between contaminant exposure and the effects that may ultimately be manifested at the population and community levels. This approach was applied to fish populations that inhabit streams receiving chronic inputs of contaminants including polycyclic aromatic hydrocarbons, polychlorinated biphenyls, heavy metals, and chlorine. Indicators such as detoxification enzymes and DNA damage have provided direct evidence of contaminant exposure, whereas indicators related to lipid metabolism, histopathology, and general bioenergetic condition have reflected effects at both the suborganism and organism level. This bioindicator approach is an effective technique to assess the integrated effects of contaminant stress on fish. (See also W91-06176) (Author's abstract)
W91-06191

COMPARATIVE EVALUATION OF SELECTED MEASURES OF BIOLOGICAL EFFECTS OF EXPOSURE OF MARINE ORGANISMS TO TOXIC CHEMICALS.

National Ocean Service, Seattle, WA. Ocean Assessments Div.
For primary bibliographic entry see Field 5C.
W91-06192

USE OF BIOMARKERS IN ECOLOGICAL RISK ASSESSMENT.

Oak Ridge National Lab., TN. Environmental Sciences Div.
G. W. Suter.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 419-426, 1 fig, 9 ref. DOE Contract DE-AAC05-94OR21400.

Descriptors: *Bioindicators, *Ecological effects, *Risk assessment, *Water pollution effects, Biological studies, Ecosystems, Environmental effects, Environmental protection, Monitoring.

Ecological risk assessors analyze the effects of human actions on the natural environment. Like other risk assessors, they have been concerned primarily with predictive assessments; those that

estimate the nature, probability, and magnitude of effects of proposed actions such as the marketing of a new chemical product or the release of a new effluent. However, risk assessors must increasingly perform retrospective assessments, assessments of human actions that were initiated in the past and may have ongoing consequences. If biomarkers are to become useful in ecological risk assessment, they must be linked to the other measures and indicators that contribute to retrospective assessments. It is not sufficient to show that biomarker levels differ among sites or even that a biomarker level is abnormally high at a site. Assessments are concerned with sources that may be regulated or remediated and with the organism, population, and community level effects that are to be prevented or mitigated. The biomarkers are intermediates between sources and higher level effects; they have no importance in themselves and must be linked to sources or overt effects. Specifically, it must be shown that biomarkers increase in a regular and predictable manner with increasing exposure and that higher level effects are predictable from biomarker levels. Otherwise, biomarker data will be suggestive of risks, but risk assessments will be based on more conventional data. (See also W91-06176) (Lantz-PTT)
W91-06193

DRINKING WATER MICROBIOLOGY: PROGRESS AND RECENT DEVELOPMENTS.
For primary bibliographic entry see Field 5F.
W91-06194

ASSIMILABLE ORGANIC CARBON (AOC) IN DRINKING WATER.
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
For primary bibliographic entry see Field 5F.
W91-06197

MICROBIOLOGY AND DRINKING WATER FILTRATION.
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W91-06200

BACTERIAL DISTRIBUTION AND SAMPLING STRATEGIES FOR DRINKING WATER NETWORKS.
Centre des Sciences de l'Environment, Metz (France).
For primary bibliographic entry see Field 5F.
W91-06204

YERSINIA ENTEROCOLITICA IN DRINKING WATER.
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5F.
W91-06209

LEGIONELLA IN DRINKING WATER.
Pittsburgh City Water Dept. PA.
S. J. States, R. M. Wadowsky, J. M. Kuchta, R. S. Wolford, and L. F. Conley.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 340-367, 6 fig, 122 ref. EPA Cooperative Agreement CR80681-01-2.

Descriptors: *Bacterial analysis, *Drinking water, *Human pathogens, *Legionella, *Pathogenic bacteria, *Pollutant identification, *Public health, *Water treatment, Amebas, Bacteria, Cooling water, Disinfection, Epidemiology, Microbiological studies, Plumbing, Reviews, Water conveyance, Water distribution, Water quality.

Research over the past decade has shown that the aerobic bacterium Legionella is a common inhabitant, usually in low numbers, of natural aquatic habitats and is also able to survive and multiply in water treated to meet drinking water standards. Legionellae are capable of multiplying within certain niches in public drinking water treatment and distribution systems, and can be cultured from these sites in low densities, following heat treatment. Following amplification in cooling towers, the organism is presumably able to directly infect individuals, particularly those at higher risk. After amplification in hot water tanks, Legionella are available to colonize other parts of the internal plumbing systems of hospitals, hotels, and even some homes. A number of abiotic factors significantly influence Legionella survival and growth, including temperature, pH, and the availability of key metals. Legionella sp. are also affected by other microorganisms. Much of the ecological interaction of Legionella with biotic and abiotic components in natural and artificial environments may be explained by relationships with amebae. Disinfection of Legionella is complicated by a demonstrated resistance to chlorine and has led to the investigation of alternate means to control the contamination of artificial systems. The EPA decided that due to the ubiquity of the organism, its resistance to chlorine, its ability to colonize plumbing systems, and uncertainty concerning the health hazard posed by its mere presence in drinking water, control of Legionella is probably more appropriate at locations where susceptible human populations reside, than at the waterworks. Better methods are still needed to detect legionellae among large numbers of other environmental organisms. Additional passive techniques are also needed to more effectively control proliferation of legionella and colonization by supporting microorganisms, especially in plumbing and cooling systems. (See also W91-06194) (VerNooy-PTT)
W91-06210

INJURY OF ENTEROPATHOGENIC BACTERIA IN DRINKING WATER.
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5F.
W91-06211

PRESENCE-ABSENCE TEST FOR MONITORING DRINKING WATER QUALITY.
Ontario Ministry of the Environment, Rexdale. Lab. Services Branch.
For primary bibliographic entry see Field 5F.
W91-06213

STATISTICAL APPROACHES TO MONITORING.
Illinois Inst. of Tech., Chicago.
C. N. Haas, and B. Heller.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 412-427, 1 fig, 1 tab, 48 ref.

Descriptors: *Bacterial analysis, *Drinking water, *Microbiological studies, *Microorganisms, *Monitoring, *Pollutant identification, *Sampling, *Statistical analysis, *Water analysis, *Water treatment, Bacteria, Data interpretation, Distribution patterns, Experimental design, Frequency distribution, Laboratory methods, Viruses, Water quality, Water sampling.

Little attention has been paid to the frequency distribution of microorganisms in the environment. Many studies which have been purported to study such distributions have failed to distinguish between real (i.e., environmental) distribution characteristics and those which might be contributed by analytical methods. There are a number of statistical techniques for isolating these analytical contributions. As a reference point for consideration of variability of an assay technique, the Poisson distribution is convenient; however, it is often found that the distribution of microorganisms in water samples does not follow the Poisson distribution. One possible mechanism which may account for non-Poisson distributions of counts among replicates is the existence of clumps of organisms. It is also possible that methods intrinsic to the analytical or sampling methodology may impose a non-Poisson distribution on replicated counts. Two of many examples of distributions for discrete variables which have greater than Poisson variability are the negative binomial and the Poisson with added zero's model. The effects of distribution of quantal assays and all-or none assays are discussed. Workers who investigate microbial density distribution should carefully consider the effect of analytical sampling errors both in their experimental design and in their data analysis techniques. (See also W91-06194) (VerNooy-PTT)
W91-06214

MICROBIOLOGICAL METHODS AND MONITORING OF DRINKING WATER.
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
W. O. Pipes.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 428-451, 1 fig, 7 tab, 32 ref.

Descriptors: *Bacterial analysis, *Drinking water, *Microbiological studies, *Monitoring, *Pollutant identification, *Water analysis, *Water quality standards, *Water treatment, Bioindicators, Coliforms, Human pathogens, Laboratory methods, Microorganisms, Pathogens, Statistical methods, Water conveyance.

Monitoring of water distribution systems for the presence of bacteria which may indicate contamination with fecal material has been practiced in the US and other countries for many years. This monitoring was originally intended to determine if the water is free of the pathogens which cause waterborne infectious diseases. However, the coliform group, which is the indicator used, is not well correlated with fecal contamination or with the presence of pathogens. Also, the selection of the number of samples and the locations for sampling is such that fecal contamination of parts of most distribution systems could persist indefinitely without being detected by routine monitoring. The standards and regulations which govern the microbiological monitoring of drinking water in the US have evolved slowly from the first standards in 1914 to the new regulations adopted in 1989. There has been research on drinking water microbiology, the water quality issues related to monitoring, and the methodology of sampling, but very few of the research findings have had much effect on the regulations. Some of the most significant research needs include: a bacterial indicator directly related to fecal contamination and/or the presence of pathogens; an indicator to replace the coliform group to indicate the probability of waterborne disease outbreaks; testing for the relationship between occurrence of coliform and waterborne disease; testing for adequacy of disinfection through a water distribution system; determination of the causes of abrupt changes in microbiological water quality; and testing which is directly applicable to development of better regulations and standards. (See also W91-06194) (VerNooy-PTT)
W91-06215

MONITORING HETEROTROPHIC BACTERIA IN POTABLE WATER.
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
D. J. Reasoner.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 452-477, 1 fig, 3 tab, 73 ref.

Descriptors: *Culturing techniques, *Drinking water, *Heterotrophic bacteria, *Microbiological studies, *Monitoring, *Pollutant identification, *Potable water, *Water quality, *Water treatment, Bacteria, Bacterial analysis, Laboratory methods, Pathogenic bacteria, Reviews.

During the past decade, interest in assessing the bacterial quality of drinking water, particularly during distribution, has renewed interest in bacterial plate count methods. The heterotrophic plate count (HPC) enumerates aerobic and facultative aerobic bacteria found in water that are capable of growth on simple organic compounds found in the culture medium. The HPC is a useful tool for monitoring the efficiency of water treatment proc-

esses, assessing changes in finished water quality during distribution and storage, assessing microbial growth on materials used in construction of water systems, and measuring bacterial regrowth of after-growth potential in treated drinking water. Common HPC techniques are the pour plate, spread plate, and membrane filter (MF) techniques. The advent of the MF method for HPC analysis has brought greater flexibility to the plate count procedure for drinking water by allowing the analysis of sample volumes larger than 1.0 mL. There is no single colony formation method and set of conditions that will allow enumeration of all bacteria that may be found in water; therefore, given the choice of methods and media available, the user should evaluate their effectiveness for the types of water that are most often analyzed. Utilities may find HPC data increasingly useful as they are pushed to control the levels of potentially harmful disinfection by-products in their waters. Greater reliance may be placed on HPC analyses to determine or predict significant water quality changes that will require some sort of treatment response. Although it is known that high concentrations of HPC bacteria can develop in favorable locations in a distribution system, there is a paucity of data on human health effects resulting from exposure to these organisms following ingestion or through the respiratory tract. (See also W91-06194) (VerNooy-PTT)
W91-06216

ENUMERATION, OCCURRENCE, AND SIGNIFICANCE OF INJURED INDICATOR BACTERIA IN DRINKING WATER.
Montana State Univ., Bozeman. Dept. of Microbiology.
G. A. McFeters.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 478-492, 2 fig, 2 tab, 55 ref. EPA Grant R807092, R805230, and CR810015.

Descriptors: *Bacterial analysis, *Bacterial physiology, *Bioindicators, *Drinking water, *Microbiological studies, *Pathogenic bacteria, *Water treatment, Bacteria, Coliforms, Culture media, Disinfectants, Laboratory methods, Microorganisms, Monitoring, Pollutant identification, Water quality.

The most prominent characteristic of injured waterborne indicator bacteria is an elevated sensitivity to selective media containing surface-active ingredients. For that reason, injury is defined as the sub-lethal physiological and structural consequence(s) resulting from exposure to injurious factors within aquatic environments. A variety of chemical, physical, and biological factors associated with water have the potential to cause injury in enteric bacteria including disinfectants (e.g., chlorine, ozone, and chloramines), metals, ultraviolet radiation, and acidic water. Hence, injury of indicator and pathogenic bacteria can occur within drinking water systems. Methods are available that effectively detect at least a proportion of injured coliforms, since sublethally injured indicator bacteria are capable of recovering the ability to grow on selective media following incubation under suitable conditions. However, the vast majority of coliforms within the system may be undetected because sublethal stress leads to decreased detection on conventional media. Pathogenic bacteria also become injured but at higher levels of stressing agents. As a result, injured coliforms are of public health significance and their detection affords an added measure of sensitivity to assist in the early detection of treatment deficiencies or contamination within domestic potable water systems. (See also W91-06194) (VerNooy-PTT)
W91-06217

ANALYSIS OF THE RELATIONSHIP BETWEEN A SAND-DOLLAR EMBRYO ELUTRIATE ASSAY AND SEDIMENT CONTAMINANTS FROM STATIONS IN AN URBAN EMBAYMENT OF PUGET SOUND, WASHINGTON.
Washington Univ., Seattle. Fisheries Research Inst.
J. P. Meador, B. D. Ross, P. A. Dinnel, and S. J. Picquelle.
Marine Environmental Research MERSDW, Vol. 30, No. 4, p 251-272, 1990. 6 fig, 3 tab, 45 ref.

Descriptors: *Bioindicators, *Echinoderms, *Marine sediments, *Sediment contamination, *Toxicity, *Water pollution effects, Analysis of variance, Chemical analysis, Copper, Dose-response relationships, Elutriate tests, Laboratory methods, Lead, Organic compounds, Pollutants, Sand dollars, Washington.

A sand-dollar embryo test was used to assess the toxicity of contaminants in sediment elutriate samples from Puget Sound, Washington. A synoptic chemical data set of priority pollutants was reduced and subjected to combinatorial clustering that grouped stations by the amount of chemicals present. Clustering was done for metals and organic compounds together and separately. Analysis of variance revealed that the embryo test was able to predict the group of stations considered least contaminated by organic chemicals but not for metals, although copper and lead could not be excluded due to confounding effects. The results generally support the additivity hypothesis of toxicity in that as total contamination increased toxicity increased. Due to a possible change in redox conditions or the release of bioorganically bound metals, it was concluded that the elutriate test may not be appropriate for assessment of metal contaminants associated with sediment. A dose-response relationship between embryo abnormality and the degree of elutriate dilution was observed that demonstrates that serial dilutions of an elutriate should be tested to properly characterize a sediment's toxicity. (Author's abstract)
W91-06240

METHOD FOR DETECTING AND IDENTIFYING THE LETHAL ENVIRONMENTAL FACTOR ON A DOMINANT MACROBENTHOS AND ITS APPLICATION TO LAKE SHINJI, JAPAN.
Tokyo Univ. (Japan). Ocean Research Inst.
M. Yamamuro, M. Nakamura, and M. Nishimura.
Marine Biology MBIOAJ, Vol. 107, No. 3, p 479-483, 1990. 10 fig, 3 tab, 11 ref.

Descriptors: *Environmental effects, *Environmental impact, *Japan, *Lethal limit, *Pollutant identification, *Water pollution effects, Benthos, Data collections, Data interpretation, Macroinvertebrates.

In conducting impact assessments it is sometimes necessary to determine whether the environmental change caused by the proposed project would result in a lethal effect to a specific species present in the field. For such a purpose, even limited data suggesting the possibility of an effect would be valuable because it would allow a focused laboratory experiment in order to examine the possibility of an effect. A new method to determine the environmental factor limiting the life of any macrobenthic animal under conditions of stress was developed. The method was based on the assumption that the influence of each environmental factor on the life of a species could be expressed by an S-shaped function having lethal, limiting, and non-limiting ranges; and the combined effect of several environmental factors was expressed by a multiple of these functions. To single out a lethal factor, the cumulative curve of abundance arranged in the order of each environmental factor was used. Comparison of these curves resulted in the identification of the most effective environmental factor capable of limiting the life of a particular species and determined its effective range. The determination can be made from a single field observation without recourse to specially prepared experimental data if a sufficiently extensive field survey was conducted. The method was applied to the field data obtained from 248 stations at Lake Shinji, Japan, in the summer of 1982. The conclusions derived from the newly developed method have not shown any contradiction with previous studies. Thus, the method seems to be useful for singling out the limiting factor from the observed data when sufficient samples are available to prepare smooth cumulative curves, especially when the observation is done in enclosed water where environmental factors such as oxygen, sulfide and mud content tend to exhibit strong correlations with each other. (Mertz-PTT)
W91-06260

RELATIONSHIPS BETWEEN THE PHYSICO-CHEMISTRY AND MACROINVERTEBRATES OF BRITISH UPLAND STREAMS: THE DEVELOPMENT OF MODELLING AND INDICATOR SYSTEMS FOR PREDICTING FAUNA AND DETECTING ACIDITY.
University Coll., Cardiff (Wales). School of Pure and Applied Biology.
G. P. Rutt, N. S. Weatherley, and S. J. Ormerod.
Freshwater Biology FWBLAB, Vol. 24, No. 3, p 463-480, December 1990. 7 fig, 7 tab, 44 ref, append.

Descriptors: *Acid rain effects, *Acidity, *Bioindicators, *Macroinvertebrates, *Pollutant identification, *Streams, Acid streams, Acidification, Aluminum, England, Hydrogen ion concentration, Model studies, Physicochemical properties, Scotland, Wales, Water chemistry.

Data on macroinvertebrate riffle fauna and physicochemistry of 368 upland streams were collated for areas in Wales, Scotland, and northwest England. Classification of the national macroinvertebrate data by the TWINSPAN program at the 'family' level produced either two or four groups of streams which differed markedly in invertebrate fauna and acidity. The analysis also produced an indicator key based on the presence/absence of macroinvertebrate taxa which could be used to allocate new sites to the stream groups. Multiple Discriminant Analysis (MDA) indicated that sets of environmental variables, which primarily included pH or aluminum and calcium concentrations, discriminated effectively between the stream groups defined by TWINSPAN. These variables were incorporated into models which predicted faunal TWINSPAN groups from physicochemical data alone. Application of TWINSPAN classification and the MDA models to new sites resulted in 75-80% agreement between the two systems when two groups were defined, and 53-55% with four groups. Agreement was lower for a second set of data, probably because chemical description was limited. Distributions of pH and aluminum concentration for the groups of test sites classified by macroinvertebrate indicator key corresponded reasonably well to distributions of these determinants at sites in the four original TWINSPAN groups. It is concluded that MDA models could be valuable for predicting the effects of factors that influence water acidification. A macroinvertebrate indicator system, derived from TWINSPAN, could be employed in surveys of stream acidity. (Author's abstract)
W91-06269

ASSESSMENT OF THE POTENTIAL FOR MIXED-FUNCTION OXYGENASE ENZYME INDUCTION IN THE EXTRAHEPATIC TISSUES OF CUNNERS (TAUTOGOLABRUS ADSPERSUS) DURING REPRODUCTION.
Environmental Protection Service, St. John's (Newfoundland).
E. L. Porter, J. F. Payne, J. Kiceniuk, L. Fancey, and W. Melvin.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 117-121, 1989. 2 fig, 9 ref.

Descriptors: *Bioassay, *Fish physiology, *Mixed-function oxygenase, *Newfoundland, *Oxygenase, *Pollutant identification, *Toxicology, Animal metabolism, Enzymes, Liver, Monitoring, Reproduction, Toxicity.

Mixed-function oxygenase (MFO) enzyme induction has been used as a sensitive biochemical indicator for use in biological monitoring and assessment studies. Over thirty field trials had been reported to 1987 with fish, indicating that induction may be common at various sites in the environment worldwide. Evidence suggests that liver tissues may be refractory to induction during reproduction. The potential for induction in extrahepatic and hepatic tissues was investigated in cun-

ners (caught in a relatively pristine area of Portugal Cove, Newfoundland) pulsed with No. 2 fuel oil at various stages of reproduction. Both male and female fish were exposed during pre-spawning, early spawning and late spawning. Induction was readily resolved in all tissues of both sexes during the three stages. The results on extrahepatic induction potential are of general toxicological interest and will be applicable in the design of future aquatic field studies. (Author's abstract)
W91-06341

RELATIONSHIP BETWEEN METALLOTHIONEIN, COPPER AND ZINC IN PERCH (PERCA FLUVIATILIS) ENVIRONMENTALLY EXPOSED TO HEAVY METALS.
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
For primary bibliographic entry see Field 5B.
W91-06348

INDUCTION OF METALLOTHIONEIN BY CADMIUM IN BLUESTRIPED GRUNT (HAEMULON SCIURUS).
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
C. Hogstrand, and C. Haux.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 191-194, 1989. 2 fig, 3 ref.

Descriptors: *Bioindicators, *Cadmium, *Fish physiology, *Grunts, *Metallothioneins, *Toxicology, *Water pollution effects, Animal metabolism, Dose-response relationships, Immunoassay, Induction, Liver, Radiochemical analysis.

Induction of metallothionein (MT) in the liver of the subtropical fish, bluestriped grunt (Haemulon sciurus), after cadmium injection, was studied in order to estimate the potential of MT as an indicator of heavy metal pollution. Hepatic MT was assayed by a heterologous radioimmunoassay (RIA) for bluestriped grunt, using antiserum raised against MT from perch (Perca fluviatilis). Two laboratory experiments were performed: a dose-response experiment and a time-course experiment. Hepatic MT was significantly induced in a dose-dependent manner in response to intraperitoneal injection of cadmium chloride. Maximum MT levels were observed in the 2200 microg cadmium/kg group, where MT values were three times higher than in the control group. In the time-course experiment, elevated MT levels were found 2 days after injection and the maximum was reached after 6 days. MT values in fish 6 days after treatment were increased five times compared to the control group. (Brunone-PTT)
W91-06349

LASER DESORPTION-IONIZATION FT-ICR MASS SPECTROMETRY: DNA-ADDUCT BASES, NUCLEOSIDES AND NUCLEOTIDES.
Pittsburgh Univ., PA.
For primary bibliographic entry see Field 5C.
W91-06366

DNA ADDUCTS AS BIOMARKERS IN GENOTOXIC RISK ASSESSMENT IN THE AQUATIC ENVIRONMENT.
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5B.
W91-06367

PRE-EXPOSURE TO 3-METHYLCHOLANTHRENE INCREASES BENZO(A)PYRENE ADDUCTS ON DNA OF BLUEGILL SUNFISH.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W91-06368

USING THE DNA ALKALINE UNWINDING ASSAY TO DETECT DNA DAMAGE IN LABORATORY AND ENVIRONMENTALLY EXPOSED CELLS AND TISSUES.
Science Applications International Corp., Narragansett, RI.
D. Nacci, and E. Jackim.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 333-337, 1989. 2 tab, 8 ref.

Descriptors: *Animal tissues, *Bioassay, *Bioindicators, *Cytology, *DNA, *Genotoxicity, *Marine animals, *Marine pollution, *Massachusetts, *Toxicology, *Water pollution effects, Animal physiology, Environmental effects, Estuaries, Fish, Gills, Invertebrates, Marine environment, Performance evaluation, Pollutants, Population exposure, Toxicity.

The DNA alkaline unwinding assay is being evaluated for use in the detection of DNA damage in marine animals exposed to environmental pollutants. DNA unwinding methods were used with in vitro cell systems to demonstrate DNA strand breaks. Cultured mammalian fibroblasts and sperm from marine fish and invertebrates (Pseudopleuronectes, Arbacia, and Mytilus) showed concentration-dependent increases in DNA strand breaks after brief exposures to alkylating agents. DNA unwinding methods were also used on DNA extracted from marine animals injected with genotoxicants and from animals exposed in situ at an estuarine site. Gills from blue mussels caged at the New Bedford Harbor Superfund Site (Massachusetts), highly contaminated with many organic and inorganic contaminants, were also examined. A significant increase in DNA strand breaks was seen in gill tissues of animals held in the contaminated site for as little as 3 days. Although not as severe, an increase in strand breaks was also seen in animals held at the control site for 28 days. This apparent damage may have resulted from low-level contamination and/or from generally poor tissue condition. These results suggest that DNA alkaline unwinding results from controlled experiments using cells briefly exposed to toxicants can be used to identify DNA strand breaking agents. While whole-animal exposures to toxicants may affect DNA integrity, unwinding results may not specifically reflect genotoxicity. (Brunone-PTT)
W91-06369

MORPHOLOGICAL CHANGES IN TROUT HEPATOCYTES EXPOSED TO ACETAMINOPHEN.
West Virginia Univ., Morgantown. Dept. of Biochemistry.
J. B. Blair, D. E. Hinton, and M. R. Miller.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 357-361, 1989. 2 fig, 11 ref. National Cancer Institute CA45131.

Descriptors: *Acetaminophen, *Bioassay, *Carcinogenicity, *Liver, *Toxicology, *Trout, *Water pollution effects, Aggregation, Cell culture, Cytology, Enzymes, Toxicity, Ultrastructure.

The use of non-mammalian model systems in environmental toxicology and chemical carcinogenesis studies is rapidly expanding. Trout liver is attractive as a model for these studies since exposure of trout and other fish to several chemical insults results in the development of hepatocellular tumors. Isolated trout hepatocytes prepared by collagenase digestion were maintained in primary culture in chemically defined, serum-free medium for 3 to 5 days to evaluate the influence of various agents on cell-cell interactions. Isolated cells were plated onto plastic culture plates coated with trout skin extracts. After 24 hours, the cells aggregate into clumps which increase in size over several days to include several hundred cells, four to ten cells deep on the surface of the plate. Microscopic evaluation suggests these aggregates reflect normal cell-cell interactions. Acetaminophen (2 to 10 mM) interferes with cell-cell aggregation. Treated hepatocytes remain rounded and mitochondria distribution is altered, occupying only the central region of the cells. Acetaminophen has little influence on LDH or DNA content, suggesting a sensitive and specific action of the drug on cell-cell interactions. These primary cultures of trout hepatocytes may provide a new experimental model for assessing sublethal effects of various toxicants on this species. (Author's abstract)
W91-06370

IN VIVO MICROSCOPY OF LIVER MICROVASCULATURE IN RAINBOW TROUT (ONCORHYNCHUS MYKISS).
California Univ., Davis. School of Veterinary Medicine.
D. E. Hinton, D. J. Lauren, R. S. McCuskey, P. A. McCuskey, and R. C. Lantz.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 407-410, 1989. 2 fig, 5 ref. NSF Grant DCB 831 6002; USPHS (NCI) Grant CA 45131.

Descriptors: *Analytical methods, *Bioassay, *Bioindicators, *Fish pathology, *Histology, *Liver, *Microscopy, *Toxicology, *Trout, *Water pollution effects, Animal morphology, Blood flow, Injury, Necrosis, Toxicity, Ultrastructure.

Morphological change is an excellent biomarker of exposure to toxicants because it is the integration of biochemical and physiological injury. Zonal patterns of necrosis in the liver have also suggested the mechanism of toxicity for certain compounds. In vivo microscopy allows the identification of portal (afferent) from hepatic (efferent) venules in histologic sections. Mature trout were surgically implanted with dorsal aortic and portal vein catheters, and in vivo microscopy of the liver surface performed through a window in the side of anesthetized, artificially ventilated animals. Blood flow patterns were recorded on video tape by injecting fluorescein solutions. Video images were digitized and superimposed to reveal the interaction between arterial and venous vessels. A repeating pattern of alternation between afferent and efferent regions of the microvascular bed was seen. The hepatic parenchyma near the convex laterorostral surface is drained by superficially placed hepatic venules. Afferent venules reach this area by passing from deeper within the liver. Arteriole distribution appeared to closely parallel portal venule distribution. Melanomacrophages were associated with arterioles. Many of these characteristics are common with the mammalian liver. However, correlation of the dimensions of cells and vascular elements between histologic sections and in vivo images are needed before terms, such as periportal or pericentral, can be assigned to routine histologic analyses. (Author's abstract)
W91-06377

HISTOPATHOLOGICAL ASSESSMENT OF NEUROTOXIC INJURY IN MAMMALS: POSSIBLE APPLICATIONS FOR SIMILAR STUDIES IN FISH.
Imperial Chemical Industries Ltd., Alderley Park (England). Central Toxicology Lab.
M. G. Simpson, S. L. Allen, and R. Sheldon.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 437-440, 1989. 1 fig, 6 ref.

Descriptors: *Analytical methods, *Bioindicators, *Fish pathology, *Histology, *Injury, *Neurotoxicity, *Toxicology, *Water pollution effects, Bioassay, Comparison studies, Necrosis, Nitrogen compounds, Organometals, Test batteries, Toxicity.

The neuropathological examination of the nervous system of fish is rarely undertaken, even when fish histopathology is used as a tool of aquatic toxicology. Conversely, in mammalian toxicology, increasing regulatory concern over the suitability of routine toxicity assays to provide sufficient data on the neurotoxic potential of some classes of industrial chemicals has stimulated the development of neurotoxicological test batteries; these use a combination of clinical, behavioral, electrophysiological and neuropathological methods. Neuropathological techniques have been used in the albino rat to identify and study chemically induced lesions of the mammalian nervous system. Examples include an organometal, trimethyltin, which induces selective necrosis of parts of the prosencephalon; a nitro-aromatic, 1,3-dinitrobenzene, which induces spongy degeneration in the rhombencephalon; an acrylo nitrile, 3,3-iminodipropionitrile, which produces a proximal axenopathy; and a hexacarbon, 2,2-hexanedione, which produces central peripheral distal axenopathy. Since little structural data is available on the responsiveness of fish to neurotox-

icants, research is necessary to determine how sensitive or refractory laboratory fish models are to mammalian neurotoxicants. (Author's abstract)
W91-06382

USE OF BIOINDICATORS FOR ASSESSING THE EFFECTS OF POLLUTANT STRESS ON FISH.
Oak Ridge National Lab., TN. Environmental Sciences Div.
S. M. Adams, K. L. Shepard, M. S. Greeley, B. D. Jimenez, and M. G. Ryon.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 459-464, 1989. 3 fig, 10 ref. US DOE Contract DE-AC05-840R21400.

Descriptors: *Analytical methods, *Bioindicators, *Fish pathology, *Fish physiology, *Stress, *Toxicology, *Water pollution effects, Chlorine, Environmental effects, Heavy metals, Hydrocarbons, Polychlorinated biphenyls, Species composition, Species diversity.

The use of bioindicators in environmental pollution studies involve monitoring a suite of selected stress responses at several levels of biological organization in order to (1) assess the effects of sublethal stress on fish, (2) predict future trends (early warning indicators) and (3) obtain insights into causal relationships between stress and effects at the community and ecosystem level. This approach has been successfully applied with redbreast sunfish (Lepomis auritus) in freshwater systems receiving inputs of complex contaminant mixtures containing polychlorinated biphenyls (PCBs), hydrocarbons, heavy metals and chlorine. Indicators such as mixed-function oxidase enzymes and DNA damage have provided direct evidence of toxicant exposure, while condition indices and indicators related to lipid biochemistry and histopathology have reflected impaired lipid metabolism, immune and reproductive system dysfunction, and reduced growth potential. At higher levels of organization, stress-mediated effects have included changes in the richness and biotic integrity of fish communities. (Author's abstract)
W91-06385

DETECTION OF MAJOR STRESS PROTEIN USING A PEPTIDE ANTIBODY.
Maryland Univ. at Baltimore. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W91-06387

DOSE/RESPONSE STUDY OF 2,3,7,8-TCDD IN THE RAINBOW TROUT (SALMO GAIRDNERI).
Utrecht Rijksuniversiteit (Netherlands). Environmental Toxicology Section.
M. E. J. van der Weiden, J. van der Kolk, W. Seinen, and M. van den Berg.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 509-513, 1989. 1 fig, 2 tab, 3 ref. Rijkswaterstaat, Ministry of Transport and Public Works, Grant No. BER-2372.

Descriptors: *Bioassay, *Bioindicators, *Dioxins, *Pollutant identification, *Rainbow trout, *Tetrachlorodibenzo-p-dioxin, *Toxicology, *Water pollution effects, Aromatic compounds, Dose-response relationships, Ethoxy-resorufin O-deethylase, Hydrocarbons, Toxicity.

In view of the widespread contamination by polychlorinated aromatic hydrocarbons (PAH), simple bioassays are needed to indicate PAH presence in the aquatic environment and effects on biota. A dose/response study was carried out with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in the rainbow trout during a twelve week period. After a single intraperitoneal administration of approximately 0.01, 0.05, 0.1,. 0.5, 1.0 and 5.0 microg/kg of this compound, no effect on growth was found. Liver enlargement only occurred with the highest dose and was found after six weeks. An increase of the spleen was observed after three and six weeks, but this effect appeared not to be dose-related. Three weeks after a dosage of 0.5, 1.0 and 5.0 microg/kg the ethoxyresorufin O-deethylase (EROD) activity was increased and dose related. However, in the first six weeks, no relationship between EROD induction and toxicological effects could be determined. (Author's abstract)
W91-06394

TEN-MINUTE DIGESTION.
Hach Co., Loveland, CO.
For primary bibliographic entry see Field 5D.
W91-06429

TESTING SEDIMENT TOXICITY WITH HYALELLA AZTECA (AMPHIPODA) AND CHIRONOMUS RIPARIUS (DIPTERA).
National Fisheries Contaminant Research Center, Columbia, MO.
C. G. Ingersoll, and M. K. Nelson.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 93-109, 1 fig, 8 tab, 58 ref.

Descriptors: *Amphipods, *Bioindicators, *Flies, *Monitoring, *Sediments, *Toxicity, *Toxicology, *Water pollution effects, Bioassay, Biological studies, Illinois, Lake Michigan, Lethal limit, Metals, Polychlorinated biphenyls, Polycyclic aromatic hydrocarbons, Sublethal effects, Waukegan Harbor.

Methods for testing the toxicity of whole sediments are described for the amphipod Hyalella azteca and the midge Chironomus riparius. Amphipod tests (static and flow-through) start with juvenile animals (approximately third instar) and continue up to 29 d until reproductive maturation. Flow through tests with the midge start with first instar larvae (<24 h old) and continue up to 29 d through adult emergence. Data obtained through these laboratory exposures can be used to assess the effects of contaminants in sediments on survival, growth or emergency of amphipods and midges. The methods were used to assess the potential toxicity of field-collected contaminated sediment from two sites in Waukegan Harbor, Illinois, an inlet of Lake Michigan contaminated with polychlorinated biphenyls (PCBs), polycyclic aromatic compounds (PACs) and metals; and a single site at Homer Lake, a small recreational lake in the agricultural region of central Illinois. Survival of both species was reduced after short-term (10-13-d) and long-term (29-d) exposure to contaminated sediment. In addition, sublethal effects were indicated by reduced growth of amphipods and a delay in emergence of adult midges. (See also W91-06691) (Author's abstract)
W91-06698

USE OF SEDIMENT HEAVY METAL BIOAVAILABILITY AS A METHOD OF ENVIRONMENTAL HAZARD ASSESSMENT.
Fluor Daniel, Greenville, SC.
J. M. Marcus, and G. I. Scott.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 110-122, 4 fig, 4 tab, 14 ref.

Descriptors: *Bioaccumulation, *Bioavailability, *Hazard assessment, *Heavy metals, *Sediments, *Toxicology, *Water pollution effects, Bioassay, Chromium, Coastal waters, Copper, Land use, Lead, Monitoring, Nickel, Oysters, Path of pollutants, Recreation, Water pollution sources.

Different areas along the rapidly developing South Carolina coastline were examined for heavy metal (Cr, Cu, Pb, Ni) inputs to nearby aquatic ecosystems using sediment levels as the relative indicator of contamination. The american oyster, Crassostrea virginica (Gmelin), was monitored concurrently for metal concentrations to assess what portion of the total sediment metal burden was biologically available for uptake and accumulation. This was accomplished by computing a sediment bioavailability factor (SBAF) that allowed the integration of sediment and tissue data into a quantitative index useful for relative comparisons between areas. Typically, the order of decreasing bioavailability was Cu > Ni > Cr > Pb. While the differences in bioavailability factors between metals at a given site were usually significantly different, the differences between sites were also significant, usually at approximately the same relative factor. The SBAF's calculated for the land use practices of recreational marinas, an industrial waste treatment facility, and an abandoned industrial site were compared and contrasted with each other and with other sites that ranged from pristine to contaminated. A graded effect on availability of metals from sediments to oysters was observed. Those practices with continuous inputs exhibited higher bioavailability factors than did those that were intermittent. (See also W91-06691) (Lantz-PTT)
W91-06699

COMPARATIVE SENSITIVITY OF SEDIMENT TOXICITY BIOASSAYS AT THREE SUPERFUND SITES IN PUGET SOUND.
PTI Environmental Services, Bellevue, WA.
R. A. Pastorok, and D. S. Becker.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 123-139, 3 fig, 4 tab, 33 ref. EPA/Battele Contract No. 68-03-3319, and EPA/PTI Contract No. 68-D8-0085.

Descriptors: *Bioassay, *Puget Sound, *Sensitivity analysis, *Toxicity, *Toxicology, *Water pollution effects, Amphipods, Biological studies, Clams, Echinoderms, Hydrocarbons, Lethal limit, Microtox, Polychaetes, Polycyclic aromatic hydrocarbons, Statistical analysis.

An evaluation was conducted on the relative sensitivity of seven sediment toxicity bioassays comprising at a total of 13 endpoints. The bioassays were conducted simultaneously on dilution series of contaminated sediments collected from three Superfund sites in Puget Sound. Sediment chemistry measurements confirmed that effective gradients of contamination were established within each of the sediment series tested. The Photobacterium phosphoreum (Microtox with saline and organic extract of sediment) and the Dendraster excentricus embryo abnormality tests were generally the most sensitive bioassays in terms of ability to detect statistically significant (P approx. 0.05) effects relative to responses to reference sediments. The rank order of statistical sensitivity of the other tests was as follows: Rhepoxynius abronius mortality = Eohaustorius estuarius mortality > Neanthes arenaceodentata biomass > Neanthes arenaceodentata mortality = Dendraster excentricus chromosomal abnormality > Rhepoxynius abronius nonreburial > Eohaustorious estuarius nonreburial = Panope generosa mortality. The bioassays differed in their statistical sensitivity (i.e., as measured by the number of significant toxic effects) and biological sensitivity (i.e., as measured by EC50) to particular sediments contaminated with different kinds of chemicals (e.g., polycyclic aromatic hydrocarbons versus metals). For example, the Photobacterium phosphoreum saline extract test was not always as biologically sensitive (i.e., low EC50) as other bioassays (e.g., the Rhepoxynius abronius and Eohaustorius estuarius bioassays appeared to be more sensitive to aromatic hydrocarbons). (See also W91-06691) (Author's abstract)
W91-06700

USE OF THE BLUE MUSSEL, MYTILUS EDULIS, IN WATER QUALITY TOXICITY TESTING AND IN SITU MARINE BIOLOGICAL MONITORING.
Environmental Research Lab., Narragansett, RI.
W. G. Nelson.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 167-175, 1 fig, 4 tab, 20 ref.

Descriptors: *Bioindicators, *Marine environment, *Sea mussels, *Toxicity, *Toxicology, *Water pollution effects, *Water quality, Biological studies, Greenwich Cove, Growth, In situ tests, Monitoring, Rhode Island.

The scope for growth (SFG) index, an instantaneous measurement of energy balance in an organism, was used to assess the physiological condition of the blue mussel, Mytilus edulis. The initial

step in this program, assessing the sensitivity of M. edulis to several known toxicants in the laboratory, indicated that the SFG of the mussel is comparable in sensitivity to those of other endpoints and test species currently used for assessing receiving waters. A second step involved using the mussel in situ to assess the impact of a municipal sewage outfall on receiving water quality in Greenwich Cove, East Greenwich, Rhode Island. This was completed twice--once before the initiation of an upgrade of the facility, and once when the upgrade was about half complete. Mussels were deployed along a dilution gradient from the sewage outfall to a control station for a period of one month. Subsets of mussels were collected after a 7-d and 30-d exposure period. The results of the first deployment indicated a significant decline in SFG after seven days at stations located proximal to the sewage outfall. A similar spatial and temporal pattern was observed in mussels, deployed for 30 days. The results of the second deployment, after a portion of the upgrade, indicated that there were no effects after the 7-d exposure and only a slight gradient in mussel SFG after 30 days, suggesting that the upgrade had a positive effect on water quality in Greenwich Cove. These data also indicate that in situ biological monitoring with mussels can be an effective method for assessing receiving water toxicity, including the evaluation of sewage treatment plant improvements. Short-term tests (7-d) can be reflective of longer-term (30-d) chronic impacts. (See also W91-06691) (Lantz-PTT)
W91-06702

REDUCIBLE DYE 2-(P-IODOPHENYL)-3-(P-NITROPHENYL)-5-(PHENYL)-2H-TETRAZOLIUM CHLORIDE (INT) FOR USE IN AQUATIC TOXICOLOGY: NOTES ON CHEMICAL STRUCTURE, ELECTROCHEMISTRY, AND TOXICITY.
Virginia Inst. of Marine Science, Gloucester Point. Div. of Chemistry and Toxicology.
For primary bibliographic entry see Field 5C.
W91-06706

SENSITIVITY OF TWO CLADOCERANS TO WATER QUALITY VARIABLES: SALINITY AND HARDNESS.
Dow Chemical Co., Midland, MI. Environmental Toxicology and Chemistry Research Lab.
For primary bibliographic entry see Field 5C.
W91-06762

ACUTE TOXICITY OF PURE PENTACHLOROPHENOL AND A TECHNICAL FORMULATION TO THREE SPECIES OF DAPHNIA.
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5C.
W91-06776

CADMIUM CONCENTRATIONS IN THE FRESHWATER MUSSEL (ELLIPTIO COMPLANATA) AND THEIR RELATIONSHIP TO WATER CHEMISTRY.
Trent Univ., Peterborough (Ontario). Environmental Centre.
For primary bibliographic entry see Field 5B.
W91-06783

PROTECTION OF HUMAN HEALTH FROM MIXTURES OF RADIONUCLIDES AND CHEMICALS IN DRINKING WATER.
Oak Ridge National Lab., TN. Health and Safety Research Div.
For primary bibliographic entry see Field 5C.
W91-06785

RATIONALISATION OF THE MASS SPECTROMETRIC AND GAS CHROMATOGRAPHIC BEHAVIOUR OF ORGANOPHOSPHORUS PESTICIDES PART 1: SUBSTITUTED PHENYL PHOSPHOROTHIOATES.
Agricultural Development and Advisory Service, Harpenden (England). Central Science Lab.
J. P. G. Wilkins.
Pesticide Science PSSCBG, Vol. 29, No. 2, p 163-181, 1990. 3 fig, 2 tab, 17 ref.

Descriptors: *Mass spectrometry, *Organophosphorus pesticides, *Parathion, *Pesticides, *Phosphothioate pesticides, *Pollutant identification, Data collections, Gas chromatography, Laboratory methods, Spectral analysis.

The mass spectrometric and gas chromatographic (GC) behavior of a series of O,O-dialkyl O-(substituted phenyl) phosphorothioates, and some related compounds is reported. In general, O,O-dialkyl phosphorothioate pesticides are readily amenable to gas chromatographic separation, a factor which greatly facilitates their identification. Commercial pesticides were studied, including Fenitrothion, Fenthion, Fenchlorphos, Fensulfothion, Cyanophos, Dicapthon, Bromophos, Temephos, Parathion, Chlorthiophos, and Cythioate. In addition, a series of O,O-dimethyl O-(monosubstituted phenyl) phosphorothioates with ortho/meta/para fluoro, chloro, bromo, iodo, nitro, methyl, methoxy, methylthio, trifluoromethyl, cyano, phenyl, amino, and hydroxy substituents was prepared. The capillary GC retention data for the synthesized compounds and the influence of isomer-substitution on elution order was analyzed. Appraisal of these data permitted an increased understanding of the influence of phenyl substitutents on the appearance of the mass spectra of these compounds. In particular, the nature and extent of mass spectrometric ortho effects, which are associated with weak molecular ion intensity, and/or the generation of rearrangement ions were determined. An understanding of these effects can be helpful in the identification of related compounds, such as technical impurities and degradation products. For example, impurities were identified in technical fenitrothion, fenthion, and fenchlorphos. The observations and findings compared favorably with data from previous studies. (VerNooy-PTT)
W91-06793

ATMOSPHERIC DEPOSITION OF ACID, HEAVY METALS, DISSOLVED ORGANIC CARBON , AND NUTRIENTS IN THE DUTCH DELTA AREA IN 1980-1986.
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 5B.
W91-06818

DETERMINATION OF TOTAL MERCURY CONCENTRATION IN WASTEWATER BY CONTINUOUS MICROFLOW ANALYSIS WITH COLD VAPOR ATOMIC ABSORPTION SPECTROMETRY.
Nagoya Univ. (Japan). Dept. of Applied Chemistry.
E. Munaf, H. Haraguchi, D. Ishii, T. Takeuchi, and M. Goto.
Science of the Total Environment STENDL, Vol. 99, No. 1/2, p 205-209, December 1990. 3 fig, 1 tab, 9 ref.

Descriptors: *Analytical techniques, *Atomic absorption spectrophotometry, *Chemical analysis, *Data acquisition, *Mercury, *Pollutant identification, *Wastewater analysis, *Water analysis, Analytical methods, Detection limits, Japan, Measuring instruments, Monitoring, Precision, Water quality standards.

When studying the toxic action of mercury (Hg) ions, accurate analysis and continuous monitoring of trace mercury in various environmental water samples are extremely important. One of the most widely used techniques for the determination of mercury is the cold vapor generation method, using stannous or borohydride compounds as reducing agents. However, a recently proposed method, based on continuous microflow analysis, uses tin (II) chloride in alkaline medium as the reducing agent. The matrix effects of diverse substances were much reduced than when using the conventional method. The continuous microflow analysis method was applied to the determination of total Hg in river water, and wastewater from laboratories and a factory treating city refuse. The stability of the method was checked by injecting a standard solution of 1.0 microgram Hg/l at the start and end of the measurement. The results of the study revealed that sub-parts-per-billion levels of mercury compounds in wastewaters from university laboratories and from a factory treating city refuse were successfully determined using the continuous microflow analysis with a cold vapor atomic absorption technique. It was also determined that continuous monitoring of total mercury at the Japanese environmental standard level (i.e., 0.5 micrograms Hg/l) could be performed using the proposed method. (Korn-PTT)
W91-06822

MICRONUCLEUS ASSAY IN ANODONTA CYGNEA FOR THE DETECTION OF DRINKING WATER MUTAGENICITY.
Pisa Univ. (Italy). Dipt. di Scienze dell'Ambiente e del Territorio.
R. Scarpato, L. Migliore, and R. Barale.
Mutation Research MUREAV, Vol. 245, No. 4, p 231-237, December, 1990, 2 fig, 3 tab, 29 ref.

Descriptors: *Analytical methods, *Bioassay, *Drinking water, *Mutagenicity, *Pollutant identification, *Water treatment, Bioaccumulation, Bivalves, Chlorination, Culturing techniques, Genotoxicity, Gills, Mussels.

A micronucleus test in gill cells of the freshwater mussel Anodonta cygnea is proposed for the detection of drinking water genotoxicity. Animals were exposed for 28 days to a drinking water sample and collected every week. Highly significant increases in spontaneous micronuclei (MN) frequency were observed at each sampling, especially after 13 days of exposure. As positive control 2 doses of mytomicin C were used (0.00000001 and 0.0000001 M). A second experiment was performed at a municipal waterworks in order to assess the role of water treatment processes in the production of mutagenic compounds. The most prevalent genotoxic effects were detected after chlorination (mean: 10.47% plus or minus 3.05, $p<0.001$). (Author's abstract)
W91-06827

USE OF A STANDPIPE TO EVALUATE GROUND WATER SAMPLERS.
Geological Survey, Stennis Space Center, MS.
For primary bibliographic entry see Field 7B.
W91-06853

POLLUTED WATER CONCENTRATES: INDUCTION OF GENETIC ALTERATIONS IN SACCHAROMYCES CEREVISIAE D7 STRAIN.
Buenos Aires Univ. (Argentina). Dept. of Toxicology.
For primary bibliographic entry see Field 5C.
W91-06887

SURVEY OF SAUDI ARABIAN DRINKING WATER FOR TRIHALOMETHANES.
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
N. M. Fayad, and B. S. Tawabini.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 305-312, February 1990. 2 fig, 2 tab, 19 ref.

Descriptors: *Drinking water, *Pollutant identification, *Saudi Arabia, *Trihalomethanes, *Water quality standards, *Water treatment, Bromides, Chlorine, Gas chromatography, Groundwater, Hydrogen ion concentration, Organic carbon, Residual chlorine, Seawater, Urban areas, Water pollution sources, Water temperature.

The concentrations of trihalomethanes (THMs) in the drinking water of 8 major cities in Saudi Arabia were determined by gas chromatography and compared with Saudi Arabian Water standards. Samples were collected July-October 1989. Levels of total residual chlorine ranged between 0.2 and 1.2 ppm. On several occasions, levels in Hail, Dammam, and Buraydah exceeded the 0.5 ppm maximum recommended level set by the Saudi Arabia Standards Organization (SASO). Nonvolatile total organic carbon levels were gen-

erally less than 0.1 ppm, the detection limit of the analyzer. THM analysis showed that brominated THMs dominate with bromoform the most abundant species in all samples. Chloroform was the least abundant THM throughout the survey area because of the high levels of bromide ion in the water. Median concentration levels of THMs in all cities falls below 10 ppb, far below the maximum allowable limit set by SASO. Maximum levels were found in Jeddah and Dammam, especially at stations where the water pH was higher than 8.5. (Doria-PTT)
W91-06896

BEHAVIORAL REACTIONS FOR THE ASSESSMENT OF STRESS IN FISHES.
North Texas State Univ., Denton. Dept. of Biological Sciences.
T. L. Beitinger.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 495-528, 1990. 1 fig, 8 tab, 208 ref.

Descriptors: *Bioindicators, *Fish, *Fish behavior, *Great Lakes, *Stress, *Water pollution effects, Bioassay, Conferences, Feeding, Growth, Oxygen, Physiological ecology, Predation, Reproduction, Reviews, Survival, Temperature, Toxicity.

Behavioral reactions of fishes are measurable, adaptive features which contribute to evolutionary fitness and can serve as biomarkers of stress. This review summarizes the influence of numerous environmental stimuli on 7 different behaviors in fishes. Avoidance-attractance behavior does not assess for stress, but instead allows a fish to avoid stressful chemicals. Temperature selection behavior meets several criteria of a good indicator of stress. Several stimuli produced significant changes in selected/avoidance temperatures of various fishes. While only a few stimuli caused an increase, several resulted in a decrease in selected temperatures. Although conditioned learning appears to be a sensitive measure of environmentally induced stress, few studies have been published, and direct field validations are not possible. A variety of stimuli can disrupt the components of feedings, often in the ppb range of concentrations. Predator-prey interactions are sensitive to a variety of stressors. In trials where only prey were exposed to a potential stressor, 94% of the stressors caused an increase in prey vulnerability, usually at levels less than 96-h LC50s. Neither of the other social behaviors reviewed, intraspecific and reproductive, although promising, has received large research attention. There is no single best behavioral bioassay method, although depending upon effects and mode of action, there is probably a 'best' behavioral bioassay for each potential stressor. (See W91-06920 thru W91-06931) (Author's abstract)
W91-06919

REVIEW OF BIOCHEMICAL METHODS AND OTHER INDICATORS TO ASSESS FISH HEALTH IN AQUATIC ECOSYSTEMS CONTAINING TOXIC CHEMICALS.
Department of Fisheries and Oceans, Burlington (Ontario).
A. J. Niimi.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 529-541, 1990. 1 tab, 136 ref.

Descriptors: *Fish, *Indicators, *Water pollution effects, Bioindicators, Environmental effects, Genetics, Great Lakes, Heavy metals, Histology, Monitoring, Physiological ecology, Research priorities, Reviews, Surveys, Tissue analysis, Toxicology.

Whole animal, cellular, biochemical, and genetic studies were reviewed to identify methods that could be used to assess the health of fish from a field perspective. The survey, which focused on the effects of chemical exposure, indicated most techniques would not be suitable for field use because threshold response levels were substantially higher than most environmental chemical concentrations. These responses could also be influenced by biological and environmental factors which increase the difficulties of determining if a change in a biological measurement is actually detrimental to fish. Several indicators would be required to determine the well-being of a natural fish population because the causes are likely to be of multiple origin. Advances in assessment techniques can likely be made at the cellular and genetic levels because laboratory and field studies indicate these indices are the most sensitive to chemical exposure. Chemical impacts on fish population health would probably occur during reproduction as this process appears vulnerable to chemical exposure. (See W91-06919 and W91-06921 thru W91-06931) (Author's abstract)
W91-06920

WHOLE-ANIMAL PHYSIOLOGICAL PROCESSES FOR THE ASSESSMENT OF STRESS IN FISHES.
North Texas State Univ., Denton. Dept. of Biological Sciences.
T. L. Beitinger, and R. W. McCauley.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 542-575, 1990. 3 fig, 9 tab, 173 ref.

Descriptors: *Bioindicators, *Fish, *Fish behavior, *Physiological ecology, *Stress, *Water pollution effects, Great Lakes, Growth, Monitoring, Oxygen, Reviews, Salinity, Swimming, Temperature, Toxicity.

General stress in fish can often be indirectly revealed by standardized laboratory tests in which stresses and healthy individuals are compared. Various techniques by which selected physiological processes of whole animals are used to detect stress are reviewed and evaluated. Reviewed tests fall into three categories. In the first, the resistance is measured in fish challenged by clearly definable stressors such as temperature, oxygen, and salinity. These methods have the advantage of economy of time, effort, and equipment. In the second category, highly integrative physiological activities such as growth and swimming are quantified. The third category comprises methods of monitoring experimental subjects exposed to water-borne pollutants. The cough-reflex test, for instance, estimates stress from relationships between chemical concentration and cough frequency. A more sophisticated approach is multiparameter monitoring, which may lead to an understanding of the nature of the morbidity of stressed fish. Here, continuous records are made of many body functions simultaneously. Although no single method appears to be the most sensitive for all stressors, there is a best method for each stressor, depending on its effects. Investigators must choose a technique suitable to the fish species, the laboratory facility, and the potential stressor. (See W91-06919 and W91-06920 and W91-06922 thru W91-06931) (Author's abstract)
W91-06921

CRITICAL APPRAISAL OF POPULATION APPROACHES IN ASSESSING FISH COMMUNITY HEALTH.
Oak Ridge National Lab., TN. Environmental Sciences Div.
D. L. DeAngelis, L. W. Barnthouse, W. Van Winkle, and R. G. Otto.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 576-590, 1990. 9 fig, 4 tab, 29 ref. EPRI Contract RP2932-2 (DOE ERD-87-672) and DOE Contract DE-AC05-840R21400.

Descriptors: *Bioindicators, *Environmental monitoring, *Fish populations, *Physiological ecology, *Water pollution effects, Computers, Fish physiology, Great Lakes, Mathematical models, Population dynamics, Stress.

The characteristics of a fish population that is healthy from the standpoint of human exploitation include its ability to produce numerous healthy, fecund, and normal-sized adults and to resist or rebound from short-term stresses. These characteristics can generally be expressed in terms of the population staying within a certain range of values in abundance, age structure, length and weight structure, condition factor, and sex ratio. Some of the traditional approaches used in studying fish populations are reviewed and it is shown that, at best, only some of the above population characteristics can be evaluated using these traditional approaches. The individual-based modeling approach is an alternative to traditional models that permits explicit representation of the feedback between the differing physiological states of individual members of the population and their ability to feed, grow, reproduce, and avoid disease and predation. It may be superior for describing and predicting population health. An example of this approach is presented that illustrates the aspects of fish population dynamics that even the simpliest individual based models can describbed as growth, survival, and predation. (See W91-06919 thru W91-06921 and W91-06923 thru W91-06931) (Author's abstract)
W91-06922

USING LAKE TROUT AS A SURROGATE OF ECOSYSTEM HEALTH FOR OLIGOTROPHIC WATERS OF THE GREAT LAKES.
North Central Forest Experiment Station, Rhinelander, WI. Forestry Sciences Lab.
C. J. Edwards, R. A. Ryder, and T. R. Marshall.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 591-608, 1990. 2 fig, 1 tab, 88 ref.

Descriptors: *Bioindicators, *Fish populations, *Great Lakes, *Oligotrophic lakes, *Trout, Computers, Environmental monitoring, Environmental protection, Expert systems, Fish management, Food chains, Habitats, Lakes, Water pollution effects.

The lake trout was selected as an exemplary organism for the detection of the well-being of oligotrophic portions of the Great Lakes. The suitability of the lake trout derives from the fact that it occupies a sensitive, integrative node at the top trophic level of the system. There, in its role as a terminal predator, the lake trout acts as a major controlling factor over the remainder of the cold-water community. To provide a practical means for management application of the lake trout as an oligotrophic ecosystem surrogate, a dichotomous key was devised and subsequently upgraded to a menu-driven, computer-based expert system. This system was designed explicitly for ecosystem managers to rapidly detect the relative state of health of an oligotrophic ecosystem. It focuses specifically on questions dealing with the niche characteristics and habitat requirements of the lake trout. An optional printed output not only describes the relative state of the system, but also underlines the areas of greatest degradation and points out current information needs. Preliminary testing of the dichotomous key on each of the Great Lakes has shown its value as a first logical and necessary step in the process of system rehabilitation. (See W91-06919 thru W91-06922 and W91-06924 thru W91-06931) (Author's abstract)
W91-06923

CHALLENGES IN THE DETECTION AND DIAGNOSIS OF PATHOLOGICAL CHANGE IN AQUATIC ECOSYSTEMS.
Ottawa Univ. (Ontario). Dept. of Biology.
D. J. Rapport.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 609-618, 1990. 1 tab, 37 ref.

Descriptors: *Environmental monitoring, *Environmental protection, *Indicators, *Pollutant identification, *Water pollution effects, Baltic Sea, Estuaries, Great Lakes, Reviews, Stress.

There are a number of challenges in developing better tools for the detection and diagnosis of pathological change in ecosystems. The use of indicators can be improved by adopting a pluralistic approach rather than relying on any one type of measure of ecosystem health. Such an approach would best meet the need for three functions that indicators should serve in the context of ecosystem health: (1) utility in diagnosis of pathological changes in ecosystems; (2) utility as an early warning indicator of ecosystem breakdown; and (3) utility in reflecting ecosystem integrity. Understanding ecosystem breakdown and rehabilitation processes is enhanced by correlating, over space and time, the appearances of symptoms of pathological change with changes in stress loadings.

Such analyses, illustrated by a case study of Kyronjoki estuary (Baltic Sea), are complex owing both to discontinuities in the response of ecosystems to stress, and to lags between the onset of stress and ecosystem response. As the practice of 'ecosystem medicine' evolves, much is to be gained by shifting the emphasis from 'curative' to 'preventive' aspects. Such an approach would suggest bolstering ecosystem coping responses to stress, thereby promoting greater immunity to the negative impacts of cultural disturbance. (See W91-06919 thru W91-06923 and W91-06925 thru W91-06931) (Author's abstract)
W91-06924

NEW STRATEGIES FOR GREAT LAKES TOXICOLOGY.
International Joint Commission-United States and Canada, Windsor (Ontario).
M. Gilbertson, G. A. Fox, M. Henry, and J. P. Ludwig.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 625-627, 1990.

Descriptors: *Environmental policy, *Fish management, *Great Lakes, *Pollutant identification, *Toxicology, Chemical analysis, Economic aspects, Food chains, Political aspects, Standards, Water pollution control, Water pollution effects, Wildlife management.

The strategy used by fisheries scientists to try to protect the Great Lakes fisheries resources has been to use analytical chemistry to determine concentrations of chemicals in the Great Lakes environment and compare results with standards derived from laboratory toxicology. In contrast, wildlife biologists initiated their work by observing actual anomalies in wild populations; these initial observations were followed by epidemiological studies. Eventually, standards could be developed for sensitive organisms at the top of the food chain. Fisheries biologists have traditionally been more closely linked to the authorities regulating water pollution than have the wildlife biologists. Thus, while advances were made in controlling conventional pollutants, until recently only marginal improvements were made in controlling persistent toxic substances that were bioaccumulated. New strategies must include new ways for managers and researchers to exchange information on chemically induced epizootics. Legitimate outlets must be found for valid scientific information to enter the regulatory process without political and economic forces being brought to bear to censor the message or censure the messenger. A return to the scientific method would bring relevance to biological and toxicological studies and relief to researchers both in the laboratory and in the field. (See W91-06919 thru W91-06925 and W91-06927 thru W91-06931) (Doria-PTT)
W91-06926

FISH COMMUNITY HEALTH ASSESSMENT: A USEFUL CONCEPT.
Institut Maurice-Lamontagne, Mont-Joli (Quebec).
P. V. Hodson.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 628-630, 1990. 2 ref.

Descriptors: *Bioindicators, *Environmental management, *Environmental monitoring, *Fish management, *Great Lakes, *Water pollution effects, Aquatic environment, Commercial fishing, Fish populations, Lake restoration, Lakes, Sport fishing, Toxicity.

The idea of fish community health assessment arose from a concern by the Great Lakes Fisheries Commission that toxic chemicals could affect fish production and reduce commercial and sports fisheries. The purpose of a assessment program should be: (1) prevention, to predict and forestall chemical effects on fish, fisheries, and the ecosystems that support fish; (2) recognition, to identify the role of chemical toxicity in impaired fisheries and to diagnose the chemical or suite of chemicals causing these problems; and (3) remedial actions, to measure the success of programs of pollution control and of fisheries rehabilitation. To recognize problems, to protect fish, and to rehabilitate fisheries, monitoring schemes based on relatively simple and rapid methods are needed where the understanding of toxic mechanisms and their ecological relevance are linked by well thought out case studies. Given the lag time in recognizing and correcting pollution problems, one cannot afford to rely on fish communities as the primary indicator of chemical effects. Fish community health is too narrow a concept to encompass management and research needs to detect chemical effects on fish. (See W91-06919 thru W91-06926 and W91-06928 thru W91-06931) (Doria-PTT)
W91-06927

COMMENTARY ON FISH COMMUNITY HEALTH: MONITORING AND ASSESSMENT IN LARGE LAKES.
Case Western Reserve Univ., Cleveland, OH. Dept. of Biology.
J. F. Koonce.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 631-634, 1990. 2 fig, 1 ref.

Descriptors: *Bioindicators, *Environmental policy, *Fish management, *Great Lakes, *Water pollution effects, *Water quality management, Administrative agencies, Aquatic environment, Conferences, Decision making, Lake Ontario, Lakes, Oligotrophic lakes.

A fundamental criticism of the notion of community health and its utility in ecosystem management is the absence of criteria to judge the value of indicators of health. Evaluation of any indicator of fish community health raises the questions: who needs it, what information should it impart to the user, and what are the desirable properties of indicators. From a fish community perspective, these questions are not easily answered. Use of lake trout as a surrogate for ecosystem health of oligotrophic waters of the Great Lakes illustrates this dilemma. Trends of ecosystem health of Lake Ontario since 1973 indicate that the lake was in a degraded state in 1973 and has not improved despite massive efforts to restore its water quality and fish communities. However, from a fishery perspective, Lake Ontario is a success story. In the current management of large systems like Lake Ontario, it is not possible to link actions and indicators of ecosystem health because there is no common relation between indicators and end points of restoration among the management agencies and jurisdictions responsible for the health of the lake. Solving this problem will require a new framework for integrated management of ecosystems. (See W91-06919 thru W91-06927 and W91-06929 thru W91-06931) (Doria-PTT)
W91-06928

DETERMINING THE HEALTH OF FISH COMMUNITIES: PARALLELS WITH HUMAN MEDICINE.
Wilfrid Laurier Univ., Waterloo (Ontario). Dept. of Biology.
R. W. McCauley.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 635-636, 1990.

Descriptors: *Environmental monitoring, *Environmental policy, *Fish management, *Pollutant identification, *Water pollution effects, Bioindicators, Environmental protection, Great Lakes, Indicators, Lake restoration.

It is evident that there is an analogy between the monitoring of health of ecosystems with that of human patients using simple clinical measurements and procedures. Fever thermometers' for fisheries take the form of a variety of physiological, biochemical, and behavioral tests that can be used on individual fish to assess the level and, in some instances, the nature of the stress. A growing proportion of unhealthy fish may result in unhealthy populations. Routine examinations of fish can alert biologists that something is seriously amiss and suggest steps that can be taken to prevent further deterioration of the environment. The fisheries manager, like the physician, must attempt to take a holistic view of the health of the ecosystem and implement changes which, on the basis of experience, will cure or prevent ill health of the patient. The methods and suggestions in this symposium should aid biologists in their attempts to diagnose ecosystem ill health with economy of effort while there is still time to save the 'patient.' (See W91-06919 thru W91-06928 and W91-06930 thru W91-06931) (Doria-PTT)
W91-06929

OBSERVATIONS ON FISH COMMUNITY HEALTH.
Environmental Protection Agency, Chicago, IL. Great Lakes National Program Office.
W. A. Willford.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 637-638, 1990.

Descriptors: *Environmental monitoring, *Environmental policy, *Fish management, *Great Lakes, *Water pollution effects, Conferences, Environmental protection, International agreements, Water quality management.

Within the context of the Great Lakes Water Quality Agreement, the reason for measuring ecosystem 'health' is the need to determine whether and how the activities and programs of man are affecting the Great Lakes. However, the Great Lakes community has been unable to identify and implement monitoring programs sufficient to allow meaningful evaluation of biotic resources. As specific biological objectives against which monitoring programs can be compared evolve and become accepted, there will be increased support for programs to measure the biological status of the Great Lakes relative to the objectives. Although there remain technical issues regarding the selection of appropriate indicators of fish community health, the resolution of these issues and implementation of monitoring and assessment programs is not currently one of science but rather the establishment of goals against which progress can be measured. If the premise is correct that, without resource goals, there will be little progress toward implementing measures of fish community health, then it is evident that those interested in seeing such measures established must apply their efforts in the immediate future toward the development of those goals. (See W91-06919 thru W91-06929 and W91-06931) (Doria-PTT)
W91-06930

ASSESSMENT AND MANAGEMENT OF FISH COMMUNITY HEALTH IN THE GREAT LAKES: SYNTHESIS AND RECOMMENDATIONS.
Ontario Ministry of Natural Resources, Maple. Fisheries Branch.
D. O. Evans, G. J. Warren, and V. W. Cairns.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 639-669, 1990. 2 fig, 2 tab, 170 ref.

Descriptors: *Environmental protection, *Fish management, *Great Lakes, *Pollutant identification, *Water pollution effects, Monitoring, Rehabilitation, Stress.

A perspective on fish community health is sought to serve as a conceptual framework for assessing the effects of toxic chemicals and other anthropogenic influences on fish communities in the Great Lakes. Methods employed for fish health investigations in the Great Lakes span molecular to ecosystem approaches, reflecting the diversity of stressors operating on the fish communities, but have tended to be applied within relatively narrow disciplinary perspectives. There is a need for broader perspectives and interdisciplinary investigation of the effects of toxic chemicals and other stressors. The adoption of a field-oriented epidemiological approach is recommended for monitoring and assessment of fish community health, supported by transdisciplinary investigative teams for ecosystem problems requiring diagnostic and remedial activities. It is suggested that Areas of Concern under Annex 2 of the 1978 Great Lakes Water Quality Agreement be used as sites for comparative management experiments involving deliberate manipulation of ecosystem processes, not only to rehabilitate these areas, but also to improve understanding of the structural and functional properties of these

systems, and to provide feedback for adjustment of the selected management options. (See W91-06919 thru W91-06930) (Doria-PTT)
W91-06931

ANALYSIS OF SULFUR IN SOIL, PLANT AND SEDIMENT MATERIALS: SAMPLE HANDLING AND USE OF AN AUTOMATED ANALYZER.
Illinois Univ., Urbana. Dept. of Forestry.
M. B. David, M. J. Mitchell, D. Aldcorn, and R. B. Harrison.
Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 1, p 119-123, 1989. 5 fig, 2 tab, 12 ref.

Descriptors: *Acid rain, *Analytical methods, *Instrumentation, *Path of pollutants, *Sediment analysis, *Soil analysis, *Sulfates, *Sulfur, Automation, Sample preparation, Sample preservation, Sampling, Statistical analysis, Vegetation.

Methods for analyzing soil, vegetation and sediment samples for total sulfur and handling soil samples for analysis of sulfur constituents were examined. A LECO automated total sulfur analyzer (SC-132) was used for analysis of vegetation, sediments and soil samples. Older LECO models using an induction furnace and a titration procedure have been found to be unsuitable for soil sulfur analysis. Newer models using a high temperature furnace combined with an infrared detector had not been evaluated. Results form the LECO analyzer compared favorably with other currently used total sulfur techniques such as alkaline oxidation. Calibrating the instrument on soil or vegetation standards using two combustion accelerators improved accuracy and recovery. The upper 99% confidence interval relative standard deviation values for duplicate samples using the LECO analyzer were <15% for mineral soil, <8% for forest floor and <3% for sediment samples. Sample analysis takes <3 min and provides a direct readout of the total sulfur value. Freeze-drying soil samples caused minor changes (<15%) in sulfur constituent analyses (Zn-HCl reduction, HI-S and extractable sulfate) when compared to fresh (field moist, refrigerated) samples. Oven drying at 65 C caused greater changes in soils than freeze-drying, primarily in extractable sulfate. (Author's abstract)
W91-06960

DETERMINATION OF SOLUBLE SELENIUM IN SOILS.
Kyoto Univ. (Japan). Dept. of Agricultural Chemistry.
H. Yamada, and T. Hattori.
Soil Science and Plant Nutrition, Vol. 36, No. 1, p 163-166, 1990. 2 fig, 1 tab, 7 ref.

Descriptors: *Analytical methods, *Selenium, *Soil chemistry, *Soil solution, *Soils, *Statistical analysis, High performance liquid chromatography, Japan, Plant physiology, Soil analysis, Soil-water relationships.

Although the selenium (Se) content in a plant is considered to reflect the content in the soil where the plant grows, the chemical form of the Se absorbed by the plants from soils has not as yet been well documented. Soluble Se dissolved from soils with water or aqueous salt solution is considered to be the main form available to plants and the relation between the Se content of plants and the concentration os soluble Se in soils has been studied. A method for the determination of trace amounts of Se using high performance liquid chromatography (HPLC) with fluorescence detection has been reported. By this method the total amount of Se in soils could be determined with a high reproducibility and sensitivity. The application of the HPLC method as a simple and rapid method of determination of soil soluble Se was evaluated. The determined values of soil extracts were reproducible with a relative standard deviation of 1.6 and 1.35, and satisfactory recoveries of added Se were obtained. (Author's abstract)
W91-06970

IMMUNOASSAYS TO DETECT AND QUANTITATE HERBICIDES IN THE ENVIRONMENT.
Guelph Univ. (Ontario). Dept. of Environmental Biology.
J. C. Hall, R. J. A. Deschamps, and M. R. McDermott.
Weed Technology WETEE9, Vol. 4, No. 2, p 226-234, April/June 1990. 5 fig, 3 tab, 23 ref.

Descriptors: *Analytical methods, *Immunoassay, *Immunochemistry, *Pesticides, *Pollutant identification, *Quantitative analysis, Biochemical tests, Chromatography, Detection limits, Phenoxy acid herbicides, Trace levels.

Immunochemical techniques offer many advantages over chromatographic methods used for pesticide trace analysis of substrates such as soil, water, plants, urine and blood. These advantages include speed of processing samples, high specificity for detecting a pesticide, reduced amount of preparation and cleanup of the sample before analysis, and a dramatic increase in the number of samples that can be analyzed. Immunoassays are based on the principle that antibodies to pesticides can be prepared, in animals, that can recognize and attach with specificity to certain chemical configurations on the surface of a molecule. Small molecules such as herbicides usually are not immunogenic but can be made so by chemically bonding them to a large immunogenic protein such as bovine serum albumin (BSA) before injection into an animal. To produce the antibodies needed for an herbicide-specific immunoassay, animals such as New Zealand white rabbits are injected subcutaneously with a solution containing the herbicide/BSA (herbicide bound to BSA). Serum is prepared from the blood and antibodies in the serum can then be used directly for an immunoassay of purified from the serum by simple biochemical techniques. Three basic types of immunoassays can be used to detect herbicides: indirect enzyme-linked immunosorbent assay (ELISA), direct ELISA, and radioimmunoassay (RIA). The principles behind monoclonal antibody production are outlined and immunoassays using polyclonal and monoclonal antibodies are compared. Specific reference is made to the development and use of indirect ELISA and RIA procedures for trace analysis of 2,4-D and picloram. (Agostine-PTT)
W91-06990

VALIDATION OF A FOUR-DAY CERIODAPHNIA TOXICITY TEST AND STATISTICAL CONSIDERATIONS IN DATA ANALYSIS.
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
J. A. Masters, M. A. Lewis, D. H. Davidson, and R. D. Bruce.
Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 47-55, 1991. 3 fig, 2 tab, 38 ref.

Descriptors: *Bioassay, *Bioindicators, *Ceriodaphnia, *Laboratory methods, *Pentachlorophenol, *Phenols, *Surfactants, *Test procedures, *Toxicity, *Toxicology, Cadmium, Data interpretation, Glycols, Heavy metals, Lead, Municipal wastewater, Statistical analysis.

The technical feasibility of a shorter alternative to the U.S. Environmental Protection Agency (EPA)-recommended 7-day chronic toxicity test with Ceriodaphnia dubia was evaluated. The results of 4-day and 7-day Ceriodaphnia dubia toxicity tests, conducted concurrently, were compared using treated municipal effluent, metals (cadmium and lead), PCP, ethylene glycol, phenol and surfactants. The experimental technique was similar for both studies with the exception of the duration and age of the test species at test initiation. The 4-day static-renewal test was initiated with 3-day-old Ceriodaphnia dubia, and 1-day-old organisms were used in the 7-day tests. The chronic values of the replicated studies, based on survival and young production, were within a factor of two in approximately 70% of the total tests conducted and in all tests conducted with municipal effluent. Based on the available results, the 4-day toxicity study appears to be a technically valid alternative to the EPA-recommended 7-day test, particularly for treated municipal effluent. An important factor in toxicity testing is the use of valid statistical procedures. The validity of the various methods for Ceriodaphnia dubia depends upon their appropriate use; however, it is difficult to justify the widespread use of multiple comparison methods, particularly Dunnett's procedure which is ideally applied to methods that depend on concentration of the test compound. (Author's abstract)
W91-06994

MITOCHONDRIAL RESPONSE TO CHLOROPHENOLS AS A SHORT-TERM TOXICITY ASSAY.
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W91-06995

EFFORT-ALLOCATION ANALYSIS OF THE SEVEN-DAY FATHEAD MINNOW (PIMEPHALES PROMELAS) AND CERIODAPHNIA DUBIA TOXICITY TESTS.
Oak Ridge National Lab., TN. Environmental Sciences Div.
L. A. Kszos, and A. J. Stewart.
Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 67-72, 1991. 1 fig, 1 tab, 7 ref. Department of Energy Contract DE-AC05-84OR21400.

Descriptors: *Bioassay, *Bioindicators, *Ceriodaphnia, *Fathead minnows, *Test procedures, *Toxicity, *Toxicology, Cost analysis, Permits, Quality control, Water quality control.

Water quality-based limits are receiving greater emphasis in National Pollutant Discharge Elimination System permits. These permits often contain requirements for conducting acute or chronic toxicity tests of wastewater and/or ambient receiving waters. The effort (in person-hours per test, ph/t) required to conduct the 7-day fathead minnow (Pimephales promelas) larval survival and growth test is analyzed along with the 7-day Ceriodaphnia dubia survival and reproduction test, and various tasks that are associated with these two static-renewal tests (e.g., maintaining cultures of the test animals, water chemistry analyses, quality assurance/quality control needs, sampling, and reporting). This analysis shows that all of these tasks require 53.6 ph/t. For six samples (e.g., five ambient samples plus a control, or five concentrations of an effluent plus a control), the fathead minnow test requires 6.9 ph/t and the Ceriodaphnia test requires 5.8 ph/t. The effort needed to maintain fathead minnow cultures is approximately equal to that needed to maintain C. dubia for water chemistry analyses (six samples), 5.5 ph/t for test preparation and takedown, 4.0 ph/t for quality assurance/quality control (QA/QC), 6.0 ph/t for report writing, and 7.0 ph/t for sampling. These considerations, in conjunction with the requirements that a laboratory's QA/QC representative not be a part of the testing procedures themselves and that the test last for 7 days, indicate that at least four people may be needed to perform all of the tasks. The maintenance of fathead minnow and C. dubia cultures may be cost-effective only if a laboratory conducts several tests per month. (Author's abstract)
W91-06996

USE OF RESPIRATORY-CARDIOVASCULAR RESPONSES OF RAINBOW TROUT (ONCORHYNCHUS MYKISS) IN IDENTIFYING ACUTE TOXICITY SYNDROMES IN FISH: PART 4. CENTRAL NERVOUS SYSTEM SEIZURE AGENTS.
Environmental Research Lab.-Duluth, MN.
S. P. Bradbury, R. W. Carlson, G. J. Niemi, and T. R. Henry.
Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 115-131, 1991. 4 fig, 5 tab, 44 ref.

Descriptors: *Acute toxicity, *Bioindicators, *Fish physiology, *Insecticides, *Nervous system, *Respiration, *Toxicity, *Toxicology, *Trout, *Water pollution effects, Chlorinated hydrocarbon insecticides, Chlorpyrifos, Endosulfan, Endrin, Organophosphorus pesticides, Pyrethrins, Rodenticides.

The respiratory-cardiovascular responses of spinally transected rainbow trout to acutely lethal concentrations of chlorpyrifos, cypermethrin, fenvalerate, endosulfan, endrin, and strychnine were examined. Common to all six toxicants, the most striking change in respiratory-cardiovascular parameters was an increased cough frequency. Ventilation frequency and volume dropped in strychnine-exposed trout, but both remained near predose levels (frequency) or elevated (volume) in the pyrethroid-and cyclodiene-exposed trout. In chlorpyrifos-intoxicated trout, ventilation frequency decreased while volume increased. Oxygen consumption remained near predose levels in the chlorpyrifos-, pyrethroid-, and strychnine-exposed trout, but increased dramatically in the cyclodiene-exposed trout. Arterial oxygen, carbon dioxide, and pH declined in all the toxicant groups. In the pyrethroid-and strychnine-exposed trout, hematocrit and hemoglobin levels tended to increase or remain constant during intoxication. Conversely, in the chlorpyrifos-exposed and cyclodiene-exposed trout, values for these parameters decreased. The responses for these pesticides (N=23 fish) were combined with five fish acute toxicity syndromes (FATS) (N=52 fish) previously described (nonpolar narcosis syndrome, polar narcosis syndrome, acetylcholinesterase inhibitor syndrome, respiratory uncoupler syndrome, and respiratory irritant syndrome) and assessed using discriminant function analyses. The final analysis resulted in 93% correct classification of the trout. (Author's abstract)
W91-07001

CONCENTRATION OF ORGANICS FROM AQUEOUS SOLUTIONS USING UNCOATED CAPILLARY COLUMNS.
Houston Univ., TX. Dept. of Chemistry.
A. Ziatkis, R. P. J. Ranatunga, and B. S. Middleditch.
Analytical Chemistry ANCHAM, Vol. 62, No. 22, p 2471-2478, November 15, 1990. 3 fig, 7 tab, 18 ref.

Descriptors: *Analytical methods, *Chemical analysis, *Organic pollutants, *Pollutant identification, *Sample preparation, *Separation techniques, *Water analysis, Capillarity, Gas chromatography, Laboratory methods, Solute transport, Temperature effects.

It is necessary to carry out preconcentration of organics prior in water to their analysis by capillary gas chromatography. A novel technique was developed for the concentration of trace organics in aqueous solutions. Concentration of organics is carried out by passage of aqueous samples through uncoated plastic and metal capillary tubing. The organic compounds are removed on the walls of the column while the water is allowed to elute from the capillary. Detailed investigations were also carried out on parameters that affect the efficiency of trapping such as the column length, column internal diameter, column internal surface area, trapping temperature, solute concentration, ionic strength of aqueous solutions, and the flow rates of solutions through trapping capillaries. Plastic type materials, and silicone in particular, are capable of removing trace organics from solution extremely efficiently. The trapping temperature and the flow rate of solutions through the columns are important parameters that contribute to the removal of organics. (Author's abstract)
W91-07012

IDENTIFICATION AND DETERMINATION OF HALOGENATED HYDROCARBONS IN WATERS OF GALICIA (N. W. SPAIN) BY HEADSPACE GAS-CHROMATOGRAPHY.
Santiago Univ. (Spain). Dept. de Analisis Quimico y Bromatologia-Toxicologia.
M. J. Freiria-Gandara, A. Alvarez-Devesa, R. A. Lorenzo-Ferreira, and F. Bermejo-Martinez.
Analytical Letters ANALBP, Vol. 23, No. 10, p 1939-1958, October 1990. 6 fig, 6 tab, 24 ref.

Descriptors: *Chlorinated hydrocarbons, *Drinking water, *Gas chromatography, *Halogenated hydrocarbons, *Pollutant identification, *Spain, Analytical methods, Chemical analysis, Chloroform, Flame photometry, Laboratory methods, Water quality standards.

Gas chromatography with semiautomatic headspace injection and flame ionization detection has been applied to the determination of halogenated hydrocarbons in drinking water in Galicia (N.W. Spain). Chromatographic and injection parameters have been optimized for quantitative determination with n-butanol as internal referenece. Of the 10 hydrocarbons studied, only chlorobenzene and dibromochoromethane were not found at any site. The most-frequently found compounds were carbon tetrachloride and tetrachloroethylene, while the highest-concentration compounds were chloroform, tetrachloroethylene and carbon tetrachloride. In all four provinces, the high limit of the concentration range of the chloroform is much higher than the limit of 30 ppb established by WHO; in all four provinces the high limit of the concentration range of 1,2-dichloroethane was under the 10 ppb limit set by WHO. The WHO limit of 10 ppb for tetrachloroethylene is exceeded in La Coruna with 198 ppb, Lugo with 17 ppb, Orense with 57 ppb and Pontevedra with 41 ppb. The limits of 3 ppb set by WHO for carbon tetrachloride are exceeded in all four provinces. The high limit of the concentration range of trichloroethylene in La Coruna, 61 ppb, is the highest of the provincial values and it is above the limits established by WHO. (Hoskin-PTT)
W91-07013

MEMBRANE FOR IN SITU OPTICAL DETECTION OF ORGANIC NITRO COMPOUNDS BASED ON FLUORESCENCE QUENCHING.
New Hampshire Univ., Durham. Dept. of Chemistry.
J. Chen, and W. R. Seitz.
Analytica Chimica Acta ACACAM, Vol. 237, No. 2, p 265-271, October 15, 1990. 4 fig, 4 tab, 10 ref. U. S. Army Cold Regions Research and Engineering Laboratory Contract DACA89-89-K-0004.

Descriptors: *Chemical analysis, *Fluorescence, *Fluorometry, *Membranes, *Nitrogen compounds, *Pollutant identification, *Water analysis, Detection limits, Explosives, Groundwater pollution, Laboratory methods, Separation techniques.

Fluorescent membrane formulations for detecting organic nitro compounds by fluorescence quenching were evaluated. The most sensitive membrane is prepared by solvent casting from cyclohexanone to incorporate pyrenebutyric acid into cellulose triacetate plasticized with isodecyl diphenylphosphate. the response follows the Stern-Volmer law for 2,4,6-trinitrotoluene (DNT). The membrane also responds to hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX). For a given set of conditions, the primary factor determining sensitivity is the extent to which each nitro compound partitions into the membrane. Detection limits are ca. 2 mg/L for DNT and TNT and 10 mg/L for RDX. Nitrogen purging prior to the measurement enhances the sensitivity and eliminates interference from oxygen. The membrane is designed to be used for remote optical in situ screening of groundwater for contamination by explosives. (Author's abstract)
W91-07014

DEVELOPMENT OF A NOVEL MULTI-ELEMENT DETECTION SYSTEM FOR TRACE METAL DETERMINATION BASED ON CHEMILUMINESCENCE AFTER SEPARATION BY ION CHROMATOGRAPHY.
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
P. Jones, T. Williams, and L. Ebdon.
Analytica Chimica Acta ACACAM Vol. 237, No. 2, p 291-298, October 15, 1990. 7 fig, 2 tab, 7 ref.

Descriptors: *Analytical methods, *Chemical analysis, *Ion exchange chromatography, *Luminescence, *Pollutant identification, *Trace metals, *Water analysis, Barium, Bismuth, Calcium, Cobalt, Copper, Gallium, Iron, Laboratory methods, Lead, Magnesium, Nickel, Rare earth elements, Strontium, Zinc.

A highly sensitive, non-selective trace metal detector based on chemiluminescence was developed. The metals separated by simple ion-exchange chromatography, bring about the displacement of cobalt from a Co-EDTA post-column reagent. The liberated coablt is then detected by the luminol-peroxide chemiluminescence reaction using a modified spectrofluorimeter as the detector. The metals determined are Mg, Ca, Sr, Ba, Fe(II), Fe(III), Co, Ni, Cu, Zn, the lanthanides, Th, Al, Ga, In, Pb and Bi. The detection limits (three times the baseline noise) range between 2 and 100 micrograms/L, depending on the analyte, for a 200-microliter injection. To demonstrate the quantitative performance of the detector, the zinc and aluminum contents of a fresh water certified reference material was determined and gave good agreement with the certificate values. (Author's abstract)
W91-07015

IN SITU VOLTAMMETRIC MEASUREMENT OF TRACE ELEMENTS IN LAKES AND OCEANS.
Geneva Univ. (Switzerland). Dept. de Chimie Minerale, Analytique et Appliquee.
M.-L. Tercier, J. Buffle, A. Zirino, and R. R. De Vitre.
Analytica Chemica Acta ACACAM, Vol. 237, No. 2, p 429-437, October 15, 1990. 8 fig, 1 tab, 23 ref. Swiss National Foundation Project No. 2000-5.512.

Descriptors: *Analytical methods, *Chemical analysis, *Lakes, *Pollutant identification, *Seawater, *Trace metals, *Voltammetry, *Water analysis, Cadmium, Copper, Dissolved oxygen, Eutrophic lakes, Laboratory methods, Lead, Switzerland, Zinc.

A submersible probe with a flow-through cell allowing in situ voltammetric measurements by means of either a mercury film or a mercury drop electrode was developed and used for in-situ determination of Mn(II) in anoxic lake water (Lake Bret, Vaud, Switzerland) and of trace metals (Cu2+, Pb2+, Cd2+, Zn2+) in oxygen-saturated seawater. Investigations of the speciation of Fe(II), Mn(II) and S(-II) in eutrophic lakes is readily undertaken by in-situ voltammetry as the sample is minimally perturbed and hydrogen sulfide degassing and oxygen contamination are avoided. This prevents any modification of the chemical equilibrium before measurement. For trace metal determinations in seawater, is has also been clearly shown that contamination problems may be circumvented by performing the measurements in situ. Trace metal concentrations as low as 30-40 picomoles were detected by this method. Further, during 1 month of measurements significant changes in metal concentrations were observed during the day, which might be correlated with physical and biological parameters (temperature, tide, turbidity, chlorophyll). Finally, when speciation of trace metals is of interest, in-situ measurements may be made without perturbation of equilibria, as degassing of dissolved oxygen is avoided and consequently no changes in pH due to carbon dioxide degassing occur. (Hoskin-PTT)
W91-07016

CONCENTRATION AND DETERMINATION OF TRACE AMOUNTS OF CHLORINATED PESTICIDES IN AQUEOUS SAMPLES.
Nottingham Polytechnic (England). Dept. of Physical Sciences.
A. Braithwaite, and F. J. Smith.
Chromatographia CHRGB7, Vol. 30, No. 3/4, p 129-134, 1990. 10 fig, 5 tab, 9 ref.

Descriptors: *Analytical methods, *Halogenated pesticides, *High performance liquid chromatography, *Pollutant identification, *Sample preparation, *Trace levels, *Water analysis, Aldrin, Chemical analysis, DDT, Dieldrin, Heptachlor, Laboratory methods.

A method for the quantitative analysis of the organochloro-pesticides heptachlor, dieldrin, DDT and aldrin in water, using the high performance liquid chromatography (HPLC) technique of on-line trace enrichment, has been developed. A standard HPLC isocratic analytical system was employed the principle modification being the in-

corporation of a short pre-column across the sample loop connections of a Rheodyne 7125 valve to serve as the trace enrichment column. Pesticide recoveries of >95% were achieved at sample flow rate of 5-15 ml/min by employing stainless steel fittings throughout the system and with 5% methanol included in the pesticide sample reservoir. The pesticides were concentrated onto a 50 mm, 10 micrometer Spherisorb ODS column; analysis was performed on a 25 cm, 5 micrometer Spherisorb ODS column with methanol-water (75:25) elution; detection was by UV absorption measurement at 220 nm and 0.64 AUFS. Resolution achieved was >= 1.16 and selectivity >= 1.14. 100 ml aqueous samples allow ppb detection of the named pesticides in real samples. Total analysis time including concentration and chromatography was less than 30 minutes. (Author's abstract)
W91-07017

IMPACT OF CD AND DIFFERENT PH ON THE AMPHIPOD GAMMARUS FOSSARUM KOCH (CRUSTACEA: AMPHIPODA).
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
For primary bibliographic entry see Field 5C.
W91-07018

POLLUTANTS IN SOIL, PARTICULARLY HEAVY METALS AND HARMFUL ORGANIC SUBSTANCES, AFTER YEARLY USAGE OF MUNICIPAL WASTES (SCHADSTOFFE IM BODEN INSBESONDERE SCHWERMETALLE UND ORGANISCHE SCHADSTOFFE AUS LANGJAHRIGER ANWENDUNG VON SIEDLUNGSABFALLEN).
Landwirtschaftliche Untersuchungs- und Forschungsanstalt, Speyer (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W91-07040

APPLICATIONS OF REMOTE SENSING TECHNIQUES FOR THE INVENTORY AND MONITORING OF ENVIRONMENTAL POLLUTION.
Geofax B.V., Oldenzaal (Netherlands).
For primary bibliographic entry see Field 7B.
W91-07052

5B. Sources Of Pollution

LINDANE POLLUTION NEAR AN INDUSTRIAL SOURCE IN NORTHEAST SPAIN.
Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Inst. de Quimica Organica General.
L. M. Hernandez, M. A. Fernandez, and M. J. Gonzalez.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 9-13, January 1991. 1 fig, 1 tab, 13 ref.

Descriptors: *Industrial wastes, *Lindane, *Path of pollutants, *Pesticides, *Spain, *Toxic wastes, *Water pollution sources, Drinking water, Food webs, Invertebrates, Pollution index, Soil contamination, Stream pollution.

Hexachlorocyclohexane (HCH) wastes are being dumped near Sabinango, Spain by a chemical company which manufactures lindane, the gamma isomer of HCH. The Gallego River runs only a few meters away from the main dumping site; apparently the pesticide waste is leaking into the drinking-water supply. Pollution levels of lindane were studied in water, soil, vegetation and invertebrates sampled in five locations on the Gallego river to evaluate its accumulation within the food webs and to determine if the residue levels exceeded the allowable limits of this pesticide in water. Extraction, purification, and analysis of HCH isomers by methods used in earlier studies indicated that lindane levels decreased with increasing distance from the lindane factory. Drinking water levels of this contaminant were below permissible limits. However, toxic levels in both abiotic and biotic substratums have not been determined. (Medina-PTT)
W91-05983

SHORT AND MEDIUM EFFECTS ON THE ENVIRONMENT OF VALENCIA, SPAIN, OF THE CHERNOBYL NUCLEAR PLANT ACCIDENT.
Valencia Univ. (Spain). Faculty of Physics.
A. Moreno, E. Navarro, F. Senent, A. Baeza, and C. Miro.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 14-21, January 1991. 2 fig, 3 tab, 14 ref.

Descriptors: *Air pollution, *Chernobyl accident, *Fallout, *Path of pollutants, *Radioisotopes, *Soil contamination, *Spain, *Water pollution, Birds, Cesium radioisotopes, European Economic Community, Gamma spectrometry, Grasses, Iodine radioisotopes, Meat consumption, Milk.

In Spain, the zone most affected by the radioactive fallout by the April 26, 1986 accident at Chernobyl was the Mediterranean coast and the Balearic Islands. In Valencia, specific activities for 11 man-made isotopes were recorded. This level of radioactive contamination in air, water, soil, grass and milk samples were analyzed by gamma spectrometry. In soil samples, there was no significant variation in activity levels in relation to previous samples. In grass samples, there was a notable increase in isotope levels of ruthenium-103, iodine-131, cesium-134 and cesium-137. These contamination levels decreased steadily in samples taken from successive days. The transmission of cesium from grass to milk corresponded with the standard value for the transmission of iodine-131 set by International Atomic Energy Agency in 1974. The radioactive plume which affected the atmosphere of Valencia showed average levels of activity which did not produce important increases in the concentrations of man-made radionuclides in other receptive media. The thrush, Turdus philomelos, was the only migratory bird found in Valencia in October that presented significant radioactive contamination levels. However, these levels were lower than the maximum permitted levels by the European Economic Communities for meat consumption. Inhalation was considered as the only main process responsible for any significant increase in individual dose equivalent. (Medina-PTT)
W91-05984

CONTAMINATION OF SOILS AND SEDIMENTS IN THE VICINITY OF A MERCURY RECOVERY PLANT.
Queen Mary Coll., London (England). School of Biological Sciences.
P. Johnston, R. Stringer, M. C. French, and J. Vallette.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 74-78, January 1991. 1 fig, 1 tab, 7 ref.

Descriptors: *Groundwater pollution, *Mercury, *Path of pollutants, *Sediment contamination, *Soil analysis, *Soil contamination, *South Africa, *Water pollution sources, Population exposure, Public health, Sediment transport, Site remediation, Springs, Stream pollution, Water analysis.

There are unconfirmed reports that a groundwater spring at the foot of the hill under a mercury metal recovery plant in Cato Ridge, Natal, South Africa is the source of mercury contamination of a river which is used extensively by the local community for water supplies, livestock watering, washing, bathing, and some fishing. Consequently, this study was conducted to assess this problem. Soil, sediment, and water samples were obtained in different locations and distances within the vicinity of this plant, situated at the head of the Mngeweni River. Analysis and particle size fraction analysis of the samples taken close to the site indicated extensive and serious contamination with mercury. A general remediation program is urgently required for the area and the exposure of both the local and wider communities should be exhaustively evaluated for all environmental media. Unfortunately, mercury contamination does not respond well to retrospective action. (Medina-PTT)
W91-05987

SANITATION IN RURAL COMMUNITIES IN BANGLADESH.
Upazilla Health Complex, Chouddogram, Comilla, Bangladesh.
For primary bibliographic entry see Field 5D.
W91-05992

UPTAKE METABOLISM AND BIOLOGICAL HALF-LIFE OF BENZO(A)PYRENE IN DIFFERENT TISSUES OF SEA BASS, DICENTRARCHUS LABRAX.
Nice Univ. (France). Dept. Absorption Biotransformation et Cancerogenese.
P. Lemaire, A. Mathieu, S. Carriere, P. Drai, and J. Guidicelli.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 223-233, December 1990. 4 fig, 46 ref. Counseil Regional of Provence Alpes Cotes d'Azur Grant 86/454 and WHO Grants EU/86/04285 and EU87/026224.

Descriptors: *Animal tissues, *Benzopyrene, *Bioaccumulation, *Metabolites, *Path of pollutants, *Polycyclic aromatic hydrocarbons, *Radioactive half-life, *Seabasses, *Toxic wastes, Fish physiology, Metabolite redistribution system, Toxicity.

The disposition of polycyclic aromatic hydrocarbons in aquatic organisms is of interest from the viewpoint of both animal and human health. The kinetics of uptake and metabolism of 14C-labeled benzo(a)pyrene were studied in various tissues of sea bass upon intraperitoneal injection of the compound. A decrease in radioactivity occurred in all tissues and the calculated half-lives were 12.4 days for fat, 6.5 days for kidney, 5.1 for intestine, 4.8 for gallbladder, 4.5 for spleen, 2.9 for muscle, 2.4 for whole body, 2.3 for gonads, 2.3 for gills, and 2.2 for liver. The kinetics of distribution of radioactivity between alkali and hexane tissue extracts were determined in order to assess the overall metabolic potential of various organs. The liver, intestine, gills, and kidney displayed a relatively high metabolic potential in comparison with the spleen, muscle, gonads, and fat. There is a fairly active metabolism or metabolite redistribution system in the muscle and also the potential for exposure of blood cells to metabolites via hydrocarbon transformation processes in the spleen. This in vivo study, in which hydrocarbon disposition was studied in various tissues, also supports the hypothesis that polycyclic aromatic hydrocarbons should not bioaccumulate to any significant degree in fish and that exposure of humans to such compounds through the consumption of fish products can be expected to be minimal. (Author's abstract)
W91-05994

FATE OF (C-14)MONOLINURON IN POTATOES AND SOIL UNDER OUTDOOR CONDITIONS.
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Oekologische Chemie.
D. Frietag, and I. Scheunert.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 256-268, December 1990. 2 fig, 4 tab, 33 ref.

Descriptors: *Degradation products, *Fate of pollutants, *Herbicides, *Monolinuron, *Path of pollutants, *Pesticide residues, *Potatoes, *Radioactive tracers, *Radioactivity techniques, Biodegradation, Chemical degradation, Leachates, Lysimeters, Soil contamination.

Phenyl carbon-14 labeled monolinuron was applied (2.5 and 1.9 kg/ha) to the soil surface of an outdoor lysimeter in two successive years; then potatoes were grown. Total recovery of C-14 in soil, plants, and leached water was about 55% (of C-14 applied) after the first growing period and about 43% after the second growing period. Radioactivity in soil contained 77.1% (based on total C-14 recovered in soil) bound residues, 15% monolinuron, and the following conversion products: N-(4-hydroxyphenyl)-N'-methoxy-N'-methylurea, N-(4-chlorophenyl)-N'-methylurea, N-(4-chlorophenyl)methylcarbamate, N-(4-chloro-

phenyl)-N-methyl-methylcarbamate, and 4-chloroformanilide. The leachate contained 0.8% (based on total C-14 recovered in leachate) N-(4-hydroxyphenyl)-N'-methoxy-N-methylurea. Potato plants contained 0.106 mg/kg radioactive residues in peeled tubers after one growing period and 15.94 mg/kg in the tops; after two growing periods, peeled tubers contained 0.091 mg/kg and tops contained 18.87 mg/kg radioactive residues. These residues consisted of bound C-14 (57.9% of total recovered in plants), N-(4-hydroxyphenyl)-N'-methoxy-N'-methylurea, N-(4-chlorophenyl)methylcarbamate, N-(4-chlorophenyl)-N-methyl-methylcarbamate, and 4, 4'-dichloroazobenzene. (Author's abstract)
W91-05997

HISTOCHEMICAL DEMONSTRATION OF MERCURY IN THE OLFACTORY SYSTEM OF SALMON (SALMO SALAR L.) FOLLOWING TREATMENTS WITH DIETARY METHYLMERCURIC CHLORIDE AND DISSOLVED MERCURIC CHLORIDE.

Aarhus Univ. (Denmark). Zoophysiology Lab.
E. Baatrup, and K. B. Doving.

Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 277-289, December 1990. 8 fig, 1 tab, 30 ref. ESF Program of Research Fellowships in Toxicology (PGT).

Descriptors: *Bioaccumulation, *Mercuric chloride, *Mercury, *Methylmercuric chloride, *Olfactory system, *Path of pollutants, *Salmon, *Tissue analysis, Autometallography, Electron microscopy, Histochemistry, Microscopic analysis, Radioisotopes, Schwann cells, Sense organs, Spectrometry.

The deposition of organic and inorganic mercury compounds was studied histochemically in the salmon olfactory system. One group of salmon was given fodder pellets containing methylmercuric chloride for 4 weeks. Other groups of fish were exposed to dissolved mercuric chloride for 2, 6, and 12 hr, respectively. In both series of experiments, the radioisotope Hg-203 was included in order to determine the accumulation of mercury in the olfactory system. Gamma-spectrometry showed that both mercury compounds accumulated in the olfactory rosettes and their nerves. Tissue sections from the rosettes and olfactory nerves were subjected to autometallographic silver enhancement, thereby rendering mercury deposits visible for light and electron microscopy. Microscopic analysis demonstrated an intense and comprehensive Hg deposition in the axons of the Schwann cells of both methylmercury and inorganic mercury-exposed fish. The two mercury compounds showed different staining patterns in the sensory epithelium. The silver grains evoked methylmercury were localized predominantly in lysosome-like inclusions within the receptor cells while those produced by mercuric chloride exposure were situated mainly along the borders of neighboring cells. This deposition of organic and inorganic mercury compounds throughout the whole length of the olfactory system supports electrophysiological studies presented elsewhere. It also demonstrated the usefulness of autometallography for this kind of study. In general, precise localization of mercury deposits in situ is an easy and informative approach to evaluating the potential toxicity of this metal in a particular tissue. (See also W91-05998) (Medina-PTT)
W91-05999

UPTAKE AND BODY DISTRIBUTION OF CHLORINATED PHENOLICS IN THE FRESHWATER MUSSEL, ANODONTA ANATINA L.

Joensuu Univ. (Finland). Dept. of Biology.
P . Makela, and A. O. J. Oikari.

Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 354-362, December 1990. 2 fig, 2 tab, 12 ref.

Descriptors: *Animal tissues, *Bioindicators, *Chlorinated aromatic compounds, *Freshwater mussels, *Path of pollutants, *Phenolics, Biological magnification, Chlorophenolics, Fate of pollutants, Metabolism, Radioactive tracers, Tissue analysis.

Freshwater mussels were exposed to C-14 labeled pentachlorophenol (PCP) and C-14 labeled 3,4,5-trichloroguaiacol (CG-3) under laboratory conditions. Uptake and body distribution in mussels as well as total water-soluble metabolites of chorophenolics in hemolymph and digestive glands were measured. The time course of chlorophenolic accumulation in the mussel soft tissue was followed by analyzing the decrease in the radioactivity in exposure water. The bioconcentration factors (BCFs, animal activity per activity in water) were measured at steady state for the soft tissue homogenate and separate organs. Both chlorinated phenolics reached a steady-state concentration during the first 24 hr. BCFs in soft tissue ranged from 145 to 342 for PCP and 34 to 125 for CG-3. Accumulations by the digestive gland (hepatopancreas) and kidneys were 2 and 1.3 times greater, respectively, than the average accumulation by the whole soft tissue. The water-soluble fraction of PCP (1-8%) and CG-3 (0.4-2.9%) in separate organs implied only a minor metabolism of chlorophenolics in this mussel. It is also demonstrated that the mussel is a bioindicator organism preferable to fish, because mussels are easier to collect, handle, transport and incubate than fish. (Author's abstract)
W91-06003

DIFFERENTIAL SORPTION OF HERBICIDES AS RELATED TO SOIL TOPOGRAPHY AND ORGANIC MATTER.

Florida Univ., Lake Alfred. Citrus Experiment Station.
A. K. Alva, M. Singh, and C. A. Anderson.

Journal of Environmental Science and Health (B) JPFCD2, Vol. 25, No. 5, p 627-642, 1990. 4 fig, 1 tab, 16 ref.

Descriptors: *Bromacil, *Herbicides, *Path of pollutants, *Pesticide kinetics, *Simazine, *Soil chemistry, *Sorption, *Topography, Citrus crops, Herbicide sorption, Leaching, Mineral nutrients, Slope effects, Soil organic matter.

The sorption of bromacil and simazine by the surface soil (0-15cm) sampled at various positions along an 8% slope citrus grove (Candler fine sand; Typic Quartzipsamment) and at various depths (0-200 cm) at upper, middle, and lower positions along the slope were investigated. The sorption of both herbicides by the top 15 cm soil decreased considerably from the upper to mid position along the slope and increased at the lower position. The organic matter content and concentrations of Ca, Mg, K, P, and Cu in the soil showed evidence of transport of organic matter and mineral nutrients from the mid position on the slope and accumulation in the lower position. The differential sorption of herbicides by the soil samples taken at various positions along the slope was closely related to changes in organic matter content. Although sorption of bromacil and simazine varied considerably at various positions along the slope, the sorption of bromacil was very similar at depths below 30 cm regardless of positions along the slope. For simazine, the sorption was much greater at all depths in the lower than in the upper and mid position of the slope. The sorption of both herbicides decreased considerably at depths below 30 cm at all positions along the slope, thus, indicating the potential for rapid leaching of the herbicides down the soil profile. (Author's abstract)
W91-06006

BACTERIOLOGICAL WATER QUALITY OF RECREATIONAL AREAS: J. PERCY PRIEST PARK, TENNESSEE.

Middle Tennessee State Coll., Murfreesboro.
J. R. Pugh, and M. L. Reyes.

Journal of the Tennessee Academy of Science JTASAG, Vol. 66, No. 1, p 13-18, January 1991. 1 fig, 5 tab, 21 ref.

Descriptors: *Coliforms, *Priest Reservoir, *Public health, *Public waters, *Recreation, *Streptococci, *Water quality, Fecal coliforms, Hydrogen ion concentration, Monitoring, Pollutant identification, Reservoirs, Temperature, Tennessee.

The use of water for recreational purposes, such as swimming, boating, and fishing is increasing, and those who use it take for granted that it is 'safe.' Seven stations, all recreational areas, on J. Percy Priest Reservoir, Tennessee, were examined from 6 May to 5 August, 1986, for the presence of fecal coliform bacteria and fecal streptococcus bacteria by the membrane filter technique. Fecal coliforms were detected in 90.8% of the samples, and fecal streptococci were detected in 99.4% of the samples. At each of the seven areas, 28 samples for fecal coliforms and 26 samples for fecal streptococci were collected during the study period and overall a total of 378 samples were collected at the reservoir. The average fecal coliform to fecal streptococcus ratio obtained in this study (0.08), for all areas combined, indicates that the fecal contamination was of nonhuman origin because the ratio was below 0.7. The temperature, pH, and specific conductance of the water was also determined. The study also indicates that the reservoir, during the study period, was 'safe' for body contact according to the pollution indicator organism standard used by the State of Tennessee Department of Health and Environment and EPA; but it also indicates that fecal streptococci should be included as a pollution indicator organism in the guidelines for recreational waters. (Author's abstract)
W91-06020

ELUTION OF ENDRIN THROUGH COMPACTED SOIL WITH ETHANOL-WATER MIXTURES.

Trevecca Nazarene Coll., Nashville, TN.
G. A. Nyssen, and D. J. Wilson.

Journal of the Tennessee Academy of Science JTASAG, Vol. 66, No. 1, p 19-22, January 1991. 4 fig, 10 ref.

Descriptors: *Endrin, *Ethanol, *Hazardous wastes, *Path of pollutants, *Pesticides, *Soil contamination, *Soil water, *Waste disposal, Benzene, Chlorinated hydrocarbon insecticides, Humus, Leaching, Organic compounds, Organic solvents, Polychlorinated biphenyls, Soil properties.

Most hazardous waste burial sites contain a number of different chemicals; the interactions between these chemicals can have a substantial impact on the degree of risk presented by a site and on the period of time required for the damage to develop. A number of studies bearing directly or indirectly on the movement of hydrophobic compounds in soils in aqueous-organic solvent systems were reviewed, and a study was conducted on the effect of ethanol concentration in aqueous permeant on the migration of endrin in a low-humus and a high-humus clay. Two soils were used: (1) a low-humus alluvial clay containing kaolinite and quartz as major constituents and considerable iron; and (2) a compost-rich garden soil which had not been treated with chlorinated pesticides for at least 15 years (a high-humus clay). Endrin spiked soil samples were then added to water filled permeameters and eluate collected over a period of three months. The results suggest that humic materials such as peat moss or rotted sawdust, might be used to markedly decrease the rather substantial impact of oxygen-containing organic solvents in enhancing the mobilities of hydrophobic organics such as organochlorine pesticides and PCBs, chlorinated benzenes, and polynuclear aromatic hydrocarbons. This increase in the mobilities of the toxic hydrophobic organic compounds in the presence of water containing organic solvents represents a synergistic effect which markedly increases the risk associated with these compounds. This factor should be taken into account in the prioritization of hazardous waste sites for remedial action. (White-Reimer-PTT)
W91-06021

EXPLANATION FOR THE DECLINE OF BACTERIA INTRODUCED INTO LAKE WATER.

Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
K. R. Gurijala, and M. Alexander.

Microbial Ecology MCBEBU, Vol. 20, No. 3, p 231-244, 1990. 10 fig, 1 tab, 26 ref. EPA Cooperative Agreement CR812233.

Descriptors: *Aquatic bacteria, *Bioindicators, *Fate of pollutants, *Lake ecology, *Pathogenic bacteria, *Population dynamics, *Protozoa, Biological pollution, Escherichia coli, Eutrophic lakes, Limnology, New York, Oligotrophic lakes, Populations, Predation, Survival.

Since explanations for the decline of bacteria in natural waters are chiefly derived from studies of pathogens or organisms that are used as indicators for pathogens, a study was initiated to investigate the mechanisms of decline of a number of other bacterial species, as well as Escherichia coli, in lake water. Water samples were collected from the surface of six lakes in New York State that ranged from oligotrophic to eutrophic. The samples were analyzed for total bacteria and protozoa, and lab-cultured bacteria were added to the water samples. The sizes of the populations of individual bacterial species diminished following their addition to water from lakes with different trophic levels at temperatures of 5, 10, 15, and 30 C. Some species persisted after their initial reduction in cell numbers, but others were undetectable after 3 to 15 days. The decline of these introduced bacteria was not a result of their inoculation at higher densities than found in nature. The death of most of the test species was not the result of starvation, abiotic factors, bdellovibrios, or bacteriophages. Despite the presence of lytic bacteria, the lake water did not have lytic activity against the test species. Protozoan predation was a significant factor in the fall in bacterial population sizes because the absence of protozoa led to the elimination or delay of the decline of the bacteria, and the addition of protozoa to lake water in which indigenous protozoa were suppressed produced the same pattern of bacterial elimination as in untreated lake water. The longer survival of the bacteria at cooler temperatures may indeed result from the longer time for the protozoa to reach densities sufficient to cause a detectable reduction in prey abundance. (Author's abstract)
W91-06023

BIOLOGICAL EFFECTS OF PETROLEUM HYDROCARBONS: PREDICTIONS OF LONG-TERM EFFECTS AND RECOVERY.
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 5C.
W91-06031

MANAGEMENT AND STATUS OF JAPANESE PUBLIC WATERS.
Setsunan Univ., Neyagawa (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W91-06039

WATER QUALITY MANAGEMENT IN THE YODO RIVER BASIN--CASE STUDY.
Setsunan Univ., Neyagawa (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W91-06046

WATER QUALITY IN THE PRIORITY WATERCOURSES OF HONG KONG IN RESPECT OF VARIOUS ENVIRONMENTAL CONTROL MEASURES.
Hong Kong Environmental Protection Dept., Wan Chai. Water Policy Group.
For primary bibliographic entry see Field 5G.
W91-06048

RAIN AND URBAN STORMWATER QUALITY.
Instituto de Pesquisas Hidraulicas, Porto Alegre (Brazil).
S. J. de Luca, L. B. Milano, and C. N. Ide.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 133-140, 1991. 5 tab, 12 ref.

Descriptors: *Acid rain, *Air pollution, *Brazil, *Chemistry of precipitation, *Precipitation, *Storm runoff, *Urban hydrology, *Urban runoff, Ammonia, Chlorides, Hydrogen ion concentration, Sulfates.

The occurrence of acid or chemical precipitation in many regions of the planet is one of the consequences of atmospheric pollution caused by man. Rainwater quality can vary according to the type of pollutant load and meteorological conditions. The quality of rain and urban stormwater in the metropolitan area of Porto Alegre, Brazil, was studied over a period of one year. There are several probable sources of atmospheric pollution in the Porto Allegre area, including oil refineries, petrochemical plants, steel mills, paper and textile factories, and tanneries. Rainwater was sampled at 23 sampling points within 30 km of Porto Allegre; samples were collected fifty times during the study period. Samples were analyzed for pH, acidity, specific conductivity, and metals. A representative basin was chosen for the urban stormwater study; sampling was performed during each rain event, and flow rate was measured every five minutes during the event using a Parshall flume. Water samples were collected every five minutes during the first 30 minutes of runoff. The results obtained in the survey show a significant occurrence of chemical and acid rain in the area. In some cases the pH of rainwater was 4.0. Sulfates, chlorides, and ammonia are the main atmospheric pollutants. The data on urban drainage quality show that, besides contaminated rain, other sources of pollution such as poor garbage collection, car exhaust, crankcase leakage, and poor street cleaning contribute to the pollution in the Guaiba River. (Tappert-PTT)
W91-06053

SYSTEMATIC POLLUTEGRAPH SIMULATION FOR REAL SCALE RIVER BASIN.
Yamaguchi Univ. (Japan). Dept. of Civil Engineering.
M. Sekine, M. Ukita, and H. Nakanishi.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 141-150, 1991. 11 fig, 10 tab, 11 ref.

Descriptors: *Japan, *Model studies, *Path of pollutants, *Pollution load, *Rainfall-runoff relationships, *Storm runoff, *Water pollution sources, Computer models, Eutrophication, Parameterization, River basins.

A model for predicting the run-off load of pollutants through rivers into eutrophic lakes and inner sea areas was developed. The model is composed of three stages: discharged load prediction, flow rate prediction, and runoff load prediction. The discharged load in the river basin is estimated by using a pollutant loading factor method. The flow-rate which is necessary for the formula to predict the runoff load was obtained by a tank model method. The runoff load prediction process consists of two stages: flow-out stage and flow-down stage. The flow-out stage represents the process in which the discharged load, including that from non-point sources, flows out through gutters or small streams into the main river. The flow-down stage represents the process in which the flow-out load flows down through the main river to an observing station. There have been many studies dealing with water quality and load of pollutants in rivers. Only a few of these studies have analyzed the relationship of human activities in the river basins quantitatively. Using this model, a computer program for pollutegraph simulation was constructed and applied to the River Ibo in Hyogo Prefecture, Japan. Although this model has many parameters, when it was applied to the river Ibo, changing only 2 parameter values adjusted the model for the river. It suggests the propriety of the combination of long-term continuous data and curve-fitting methods for deciding the parameter values of complicated systems. This model provides the most accurate test available for measuring the level of pollutants in a specific river system. (Tappert-PTT)
W91-06054

ENVIRONMENTAL STUDIES OF A MARINE WASTEWATER DISCHARGE FROM A SULPHITE PULP MILL--EXAMPLE OF A GENERAL STUDY APPROACH FOR MARINE INDUSTRIAL DISCHARGES.
Region of Storstrom, Parkvej 37, DK-4800 Nykobing F., Denmark.
N. Nyholm, H. Bach, J. Birkland, T. L. Jensen, and K. Kusk.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 151-161, 1991. 3 fig, 7 tab, 13 ref.

Descriptors: *Biological studies, *Fate of pollutants, *Industrial wastewater, *Marine pollution, *Path of pollutants, *Pulp and paper industry, *Water pollution sources, Ecosystems, Environmental effects, Model studies, Monitoring, Wastewater analysis, Wastewater composition.

The results of comprehensive environmental studies of a marine discharge from a pulp mill illustrates a general strategy for environmental impact assessment and management of marine industrial wastewater discharges. The strategy includes the following elements: (1) a thorough chemical and ecotoxicological characterization of the wastewater, including degradability studies, (2) field monitoring, (3) cage studies with transplanted organisms, (4) hydrographical studies and subsequent dilution and fate modeling of wastewater and wastewater constituents, and (5) quantitative evaluation of the environmental impact and predictive evaluations of possible abatement measures. This is done by using the combined results of laboratory tests, chemical analyses, and dilution/fate modeling to confine areas around the outfall where adverse effects of various categories can be expected under various environmental settings. Results from field studies are used for comparison and verification. The present study deals with a discharge of unbleached semichemical sulfite pulp effluent which caused oxygen depletion and toxic effects, in particular towards phytoplankton algae. The general study approach was found to be useful, and it was concluded in this case that biological field data alone gave limited clues to assessing and mitigating the pollution. This was due to the time and spatial variability of the data, and the limited possibilities of distinguishing effects of occasional oxygen depletion from toxic effects. Biological field studies were useful to assess the problem initially, however, and necessary to complement the calculated estimates both qualitatively and to give the study credibility. (Author's abstract)
W91-06055

OCCURRENCE AND SIGNIFICANCE OF TOXIC CYANOBACTERIA IN SOUTHERN AFRICA.
Council for Scientific and Industrial Research, Pretoria (South Africa). Div. of Water Technology.
W. E. Scott.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 175-180, 1991. 1 fig, 2 tab, 25 ref.

Descriptors: *Algae, *Algal blooms, *Algal toxins, *Cyanophyta, *Microcystis, *South Africa, *Toxins, Eutrophication, Reservoirs, Species lists.

A comprehensive list is provided of more than forty cyanobacterial species and genera reported to have toxic properties. In South Africa the majority of animal poisonings since 1927 have been caused by a single species, Microcystis aeruginosa. Although other toxic species also occur in southern Africa, to date they have been of little practical significance. The widespread distribution of M. aeruginosa throughout southern Africa indicates a tremendous potential for toxic blooms to develop with increasing eutrophication. In 1988 and 1989 nine samples of surface scums of Microcystis blooms were collected and analyzed from South African reservoirs. Using high performance liquid chromatographs (HPLC) techniques up to six different toxin variants have been quantified. The amounts, proportions, and toxicity of the different toxins in the samples varied over a wide range, and several additional unidentified toxins were detected. Future research should concentrate upon the long term effects of toxins on health and on cheaper methods for the removal of toxins or toxic algae from water. (Author's abstract)
W91-06057

UNSTEADY TRANSPORT OF POLLUTANTS IN RIVERS DUE TO PULSE DISPOSAL.

Institute of Technology, Baghdad (Iraq). Dept. of Irrigation.
B. T. Al-Kadi, and Q. N. Fattah.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 191-200, 1991. 4 fig, 1 ref.

Descriptors: *Chemical interactions, *Convection, *Diffusers, *Dispersion, *Model studies, *Path of pollutants, *Wastewater disposal, Dispersion coefficient, Fate of pollutants, Fourier analysis, Laplace equation, Mathematical equations, Mixing, Rivers.

Mixing of pollutants in rivers is accomplished by the process of mechanical dispersion. Physically, dispersion may be considered a hydraulic mixing process, by which the waste concentrations are attenuated while the waste pollutants are transported downstream. Turbulent diffusion and velocity gradients are the two main mechanisms in dispersion. An exact analytical solution of the two-dimensional unsteady convective-dispersion equation describes the concentration distribution for a conservative pollutant or substance, injected as a pulse (not continuous) into a river by a diffuser pipe installed normal to the direction of the river bank. The river has a constant mean velocity and a relatively large discharge in comparison to the pollution discharge. The solution is developed using Laplace and finite Fourier transforms. The distribution of the transporting concentration of the pollutant in the river due to such disposal is developed in terms of error functions, exponential, and trigonometric series. Variations in the location of the diffuser pipe in the river, the concentration distribution as a function of time, and the effects of variations in river velocity and lateral and longitudinal dispersion coefficients on the mixing patterns can be simulated. The solution presents variations in concentration distribution in the river with time during and after the pulsing injection period of the pollutant. It was observed that increasing the pulse duration causes a significant rise in the lateral concentration distribution, decreasing the longitudinal dispersion coefficient causes a slight drop in the longitudinal concentration distribution, and decreasing the lateral dispersion coefficient causes a significant rise in the longitudinal concentration distribution. (Author's abstract)
W91-06059

CASE HISTORY: MINIMATA MERCURY POLLUTION IN JAPAN - FROM LOSS OF HUMAN LIVES TO DECONTAMINATION.

National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
A. Kudo, and S. Miyahara.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 283-290, 1991. 4 fig, 2 tab, 8 ref.

Descriptors: *Bioaccumulation, *Cleanup, *Cleanup operations, *Decontamination, *Japan, *Mercury, *Minimata Bay, *Mortality, *Population exposure, *Water pollution effects, Case studies, Contamination, Industrial wastewater, Sediments, Toxicity, Water pollution sources.

At Minamata Bay in Japan more than 100 people lost their lives and many thousands more were permanently paralyzed from eating fish contaminated with mercury. In the long history of water pollution, this was the first known case where the natural bioaccumulation of a toxicant from an industrial wastewater killed a large number of human beings. The mercury, discharged from a factory, was deposited on the bottom of the Bay and has remained there since the 1950s. The fate of the mercury has been traced by measuring 268 mercury concentrations in the surface sediments at Yatsushiro Sea (outside of the Bay) during the last 14 years. Twenty-four sampling stations were established, and samples were collected at the same location every year. Samples were analyzed for total mercury contamination. The concentrations of mercury in the surface sediments at the Sea were not alarming; only 33 samples exceeded a mercury concentration of 1 ppm. The dispersion of mercury from the Bay, however, was clearly documented with the data. On average, 3.7 tons of the mercury was transported outside from the Bay every year. A decontamination project started in 1984 dramatically decreased the flow of mercury from the Bay to the Sea. A historic rainfall in 1982 also 'purified' the surface sediments. Organic mercury concentration in the sea water was 5.1 ng/L while total mercury was 120 ng/L at the center of the Bay in 1985. (Author's abstract)
W91-06070

FATE OF PLUTONIUM RELEASED FROM THE NAGASAKI A-BOMB, JAPAN.

National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
A. Kudo, Y. Mahara, T. Kauri, and D. C. Santry.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 291-300, 1991. 5 fig, 2 tab, 13 ref.

Descriptors: *Bioaccumulation, *Fallout, *Japan, *Nagasaki, *Nuclear explosions, *Path of pollutants, *Plutonium, *Radioactive wastes, *Radioactivity, *Radioactivity effects, Fate of pollutants, Reservoirs, Sediments, Soil analysis, Tissue analysis.

About 15 kg of plutonium was used in the Nagasaki A-bomb, but only 1 kg was fissioned and the rest (14 kg) was released into the environment. The fate of this plutonium was investigated on the east side of Nagasaki city, where the local fallout was deposited. The four objectives of the investigation were: (1) the geographical distribution of plutonium up to 100 km from the hypocenter, (2) the vertical movement of the deposited plutonium within a soil core and a reservoir sediment core, (3) the ecological distribution, and (4) an estimate of the total mass deposited as local fallout. Forty-seven surface soils samples, two soil core samples, one sediment core from Nishiyama Reservoir, and biological samples were collected. The highest concentration of 239+240Pu, 64.5 mBq/g, was found at a point 2.8 km from the hypocenter. The local fallout was observed over a limited area up to 18 km east from the hypocenter. Plutonium was mobile within the soils and reservoir sediments. For soils 10% moved downward during the last four decades and the rest (90%) remained within 10 cm of the surface. A considerable amount of plutonium was found in fish (0.0195 mBq/g dry), freshwater shellfish (0.0278 mBq/g dry), ginger root (0.0366 mBq/g dry), and sweet potato (0.0110 mBq/g dry). The estimate of plutonium deposited as local fallout from the A-bomb was 37.54 grams. (Author's abstract)
W91-06071

EVALUATION OF GENOTOXICITY USING DNA REPAIRING TEST FOR CHEMICALS PRODUCED IN CHLORINATION AND OZONATION PROCESSES.

Kyoto Univ. (Japan). Dept. of Environmental and Sanitary Engineering.
Y. Ono, I. Somiya, and M. Kawamura.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 329-338, 1991. 8 fig, 3 tab, 10 ref.

Descriptors: *Chlorination, *Disinfection, *Mutagenicity, *Ozonation, *Toxicity, *Toxicology, *Water treatment, DNA, Genetic engineering, Halogenated organic compounds, Salmonella, Water analysis, Water chemistry.

The umu-test, which can detect the induction of DNA repair, can be used to analyze the genotoxicity of the by-products of chlorination and ozonation. This procedure uses the bacterial strain Salmonella typhimurium TA1535 and involves a plasmid (pSK1002) which carries the fused gene umuC'-'locZ. The genotoxicities of 37 commercial chemicals expected to be present in the by-products of chlorination and ozonation processes were checked and evaluated by the umu-test. The genotoxicities of the following organic halogenated compounds are clearly detected: without microsomal activation, m-dichlorobenzene, 1,2,4-trichlorobenzene and bromoform are detected; with microsomal activation, m-dichlorobenzene, dichloroacetic acid, trichloroacetic acid and chloral are detected. From the results on some compounds which are expected to be produced by ozonation, formaldehyde and ionone show positive genotoxicities without microsomal activation, and five compounds have positive genotoxicities with microsomal activation (formaldehyde, furfrol, carvone, glyoxal and acrolein). Some of the selected organic compounds identified as positively genotoxic, such as chloroform, have been reported not to be mutagenic in other bacterial assays. (Tappert-PTT)
W91-06075

AGEING EFFECTS OF HIGHMOLECULAR WEIGHT ORGANIC ACIDS WHICH CAN BE ISOLATED FROM LANDFILL LEACHATES.

Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
F. H. Frimmel, and M. Weis.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 419-426, 1991. 5 fig, 5 tab, 23 ref. Deutsche Forschungsgemeinschaft grant FR536-9.

Descriptors: *Aerobic conditions, *Anaerobic conditions, *Fate of pollutants, *Landfills, *Leachates, *Organic acids, *Path of pollutants, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Model studies, Sand models, Temporal variation.

The huge number of landfills and the resulting seepage water (leachate) has had a negative influence on groundwater quality. Organic acids were isolated over a period of three years from anaerobic and aerobic leachate water, and from two model sand aquifers fed with the leachates. The model aquifers were 100 m long, 1 m wide, and 2.2 m deep. The amount of isolated DOC increased from the anaerobic samples to the aerobic ones. There is a clear decrease in DOC and COD and an increase in the redox potential as the leachate passes through the sand aquifers. The characterization of the isolated acids clearly reflects an increase of the molecular weight and the functional group content with increasing age of the landfill and the process of aerobic digestion. The results are not only of interest for a detailed understanding of the fate of organic material from landfill leachates and of the transport of pollutants in the groundwater, but represent a man-made influence on the genesis of humic substances. (Author's abstract)
W91-06085

SORPTION OF POLYCYCLIC AROMATIC HYDROCARBONS ONTO NATURAL SOLIDS: DETERMINATION BY FLUORESCENCE QUENCHING METHOD.

Texas Univ. at Austin. Dept. of Civil Engineering.
Y. Shimizu, and H. M. Liljestrand.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 427-436, 1991. 7 fig, 3 tab, 39 ref.

Descriptors: *Analytical techniques, *Fluorescence, *Path of pollutants, *Polycyclic aromatic hydrocarbons, *Soil contamination, *Sorption, *Waste treatment, Adsorption kinetics, Anthracene, Hydrogen ion concentration, Organic carbon, Sediments, Soils.

A fluorescence quenching method was used to determine the sorption of polycyclic aromatic hydrocarbons (PAHs) onto natural solids in batch experiments. This method is based upon the observation that PAHs fluoresce in aqueous solution but not when associated with natural solids. It avoids problems of incomplete solid-liquid separation. As natural solids, eleven different USEPA soils and sediments were used. Anthracene and 2-aminoanthracene, which are respectively non-ionic and ionic PAHs, were chosen as sorbates. The fractional decrease in fluorescence intensity as a function of added natural solid concentration is referred to as Stern-Volmer plots. The plots were linear for all natural solids investigated. The conditional sorption coefficients at pH 6 through 8 and I=0.1M were obtained as the slopes of the plots. While the conditional sorption coefficients of anthracene were independent of pH, the values of 2-aminoanthracene decreased with increasing pH. The conditional sorption coefficients of anthracene correlated well with the organic carbon content of natural solids. However, the values of 2-aminoanthracene did not depend on the content of organic carbon in natural solids. For 2-aminoanthracene, inorganic matrices of the natural solids may contribute to the sorption. (Author's abstract)
W91-06086

LINEAR ALKYLBENZENES (LABS) IN URBAN RIVERINE AND COASTAL SEDIMENTS AND THEIR USEFULNESS AS A MOLECULAR INDICATOR OF DOMESTIC WASTES.

Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Environmental Science and Conservation.
H. Takada, and R. Ishiwatari.

Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 437-446, 1991. 4 fig, 3 tab, 25 ref.

Descriptors: *Detergents, *Domestic wastes, *Path of pollutants, *Sediment contamination, *Surfactants, *Tokyo, *Tracers, Coastal sediments, Fluvial sediments, Indicators, Microbial degradation, River sediments, Urban areas.

Urban riverine and coastal environments are receiving large amounts of organic pollutants derived from various sources. Linear alkylbenzenes (LABs) and linear alkylbenzenesulfonates (LAS), found in detergents, are useful tracer compounds for domestic waste. LABs and LAS were measured in river and coastal (bay) sediments in the Tokyo metropolitan area. LABs are widely distributed in the sediments with concentrations of a few ug/g-dry sediments. LAS concentrations in sediments are extremely low in Tokyo Bay (approximately 0.01 ug/g) compared to those in the rivers (hundreds of ug/g). This fact indicates the higher persistency of LABs in the riverine and coastal sediments. The progressive relative depletion of external isomers (in which the phenyl group is attached near the end of the alkyl chain) was observed on going from the source (LABs in commercial LAS-detergents) to Tokyo Bay sediments. An incubation experiment substantiated that the isomeric change of LABs is caused by selective microbial degradation. The I/E ratio (ratio of internal isomers relative to external isomers) is proposed as an index of LAB degradation. I/E ratio of LABs in Tokyo Bay sediments indicates the degree of degradation of LABs to be 50% at most. (Author's abstract)
W91-06087

SORPTION KINETICS OF NON-IONIC ORGANIC POLLUTANTS ONTO SUSPENDED SEDIMENTS.

Texas Univ. at Austin. Dept. of Civil Engineering.
H. M. Liljestrand, and Y. D. Lee.

Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 447-454, 1991. 4 tab, 37 ref.

Descriptors: *Adsorption kinetics, *Adsorption-desorption, *Model studies, *Organic pollutants, *Path of pollutants, *Sorption, *Suspended sediments, Chemical processes, Dichlorobenzene, Diffusion, Equilibrium, Particle size, Sediments.

A number of models have been proposed to describe the fate and distribution of sorbing pollutants in surface waters. For the adsorption and desorption processes, they frequently assume instantaneous equilibrium. The assumption of instantaneous equilibrium may result in serious errors if the adsorption kinetics are not rapid relative to the physical transport times. The results of controlled batch experimental studies of the adsorption and desorption kinetics of dichlorobenzene to (1) size fractionated, washed sediments, (2) aggregate, washed sediment, (3) dissolved/colloidal sediment materials, and (4) bulk sediments, are used to determine the effect of inhomogeneous mixtures on the overall sorption rates. The size-segregated sediments are modeled as spherical particles with a porous outer shell of organic matter for sorption and an inert, inorganic core. The characteristic times of intraparticle diffusive transport are found to vary with particle size by about two orders of magnitude. The distribution of natural organic matter content with particle size results in sorption rates which differ greatly from those predicted by the monodisperse, homogeneous particle model. Coupled, reversible reactions between the solute and each solid size fraction are regarded as a conceptual model for the interpretation of the empirical results of batch experiments. (Author's abstract)
W91-06088

FACTORS EXPLAINING SEDIMENT CONCENTRATIONS OF 16 ELEMENTS IN 28 JAPANESE EUTROPHIC LAKES.

National Inst. for Environmental Studies, Tsukuba (Japan).
T. Fukushima, K. Amaro, and K. Muraoka.

Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 465-474, 1991. 8 fig, 5 tab, 17 ref.

Descriptors: *Eutrophication, *Japan, *Path of pollutants, *Sediment contamination, *Suspended solids, *Trace elements, Eutrophic lakes, Lake sediments, Lakes, Organic carbon, Organic nitrogen, Particulate matter, Water chemistry.

Most anthropomorphic activities in a lake or its watershed will leave traces in the sediments. To understand lake sediment environments, the concentrations of 16 elements in sediments and suspended particulate matter (PM) from 28 eutrophic Japanese lakes were analyzed. Surface sediments were used because they are more closely related to the chemistry of the water column and less affected by chemical processes such as decomposition. Several sediment cores 10-20 cm long were collected from each of the study lakes and subjected to both physical and chemical analysis. Use of statistical analysis permitted the elements to be grouped into (1) alkali metals and alkaline earth metals (Na, Mg, Ca, Sr, K), (2) elements originating from soil particles or rock (Ti, Fe), (3) elements having significant anthropogenic inputs (P, Cr, Cu, Zn), (4) organic carbon and nitrogen. The ratio of PM to sediments decreased in the order of (3), (4), (1), and (2). With the aid of a simple conceptual model, some significant factors were successfully shown to explain the sediment concentrations of respective groups: (1) salinity of the lake water, (2) Ti concentration in PM, which reflects the arrival rate of soil particles at the midpoint, (3) total phosphorus (TP) concentration in lake water representing the anthropogenic load, (4) chlorophyll-a concentration in lake water divided by the area ratio of drainage to lake surface. (Author's abstract)
W91-06090

SURFACTANT SOLUBILIZATION OF POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS IN SOIL-WATER SUSPENSION.

Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W91-06091

FATE OF LINEAR ALKYLBENZENESULFONATES IN A LAKE ESTUARY.

National Inst. for Environmental Studies, Tsukuba (Japan).
K. Amano, T. Fukushima, and O. Nakasugi.

Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 497-506, 1991. 8 fig, 2 tab, 15 ref.

Descriptors: *Biodegradation, *Japan, *Lake sediments, *Lakes, *Linear alkyl sulfonates, *Path of pollutants, Diffusion, Distribution patterns, Estuaries, Mathematical models, Rivers, Sediment analysis.

The concentration of linear alkylbenzenesulfonates (LAS) in the Lake Teganuma estuary in Japan indicated a seasonal variation and a downstream decrease. The downstream decrease in the studied section varied between 28% and 100% seasonally, and the average was 66(+-25)% during 1987-1988. To explain the decrease, the biodegradation of LAS in water, diffusive exchange of dissolved phase LAS through the sediment/water interface, and settling of adsorbed phase LAS was investigated through analysis of sediment samples. Six sampling locations in the Lake Teganuma estuary were established. Adsorption experiments were performed between 0.3-9 ppm of the initial concentrations of LAS. The experimental equation used to estimate the adsorption coefficient of LAS was verified by using adsorption data from field observations. The averaged value 0.000024 square centimeters per second for the diffusion coefficient in the sediment interstitial water was obtained from the experiments using the sediment core samples. The biodegradation rate constant (between 0.06 and 3.33 per day) in water and the diffusive flux rate (between -0.157 and 0.022 mg per square meter per hour) from water to sediment were obtained from field observations and experiments. Based on this information, a mathematical model was applied to simulate the downstream decrease of LAS in water. With this model, nearly 10% of the total LAS from the river was found to be transported to sediment both in summer and winter. The settling flux of LAS in the lake estuary was ten times greater than the diffusive flux. The settling flux was ten times smaller than the disappearing flux by biodegradation in summer but was the same level in winter. (Author's abstract)
W91-06093

ENVIRONMENTAL TRANSFORMATION, PHOTOLYSIS OF FLUORESCING PETROLEUM COMPOUNDS IN MARINE WATERS.

Kuwait Inst. for Scientific Research, Safat. Environmental and Earth Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06094

WEIGHTED FINITE DIFFERENCE AND BOUNDARY ELEMENT METHODS APPLIED TO GROUNDWATER POLLUTION PROBLEMS.

Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
M. Kanoh, T. Kuroki, K. Fujino, and T. Uda.

Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 517-524, 1991. 8 fig, 7 ref.

Descriptors: *Boundary element method, *Finite difference methods, *Groundwater pollution, *Model studies, *Path of pollutants, Computer models, Convection, Dispersion, Groundwater movement, Numerical models, Organic compounds.

Two methods for evaluating groundwater pollution in porous media are applied to three theoretical examples. The methods are the weighted finite difference method (WFDM) and the boundary element method (BEM), which were proposed or developed for advective diffusion problems. By subdividing the domain into subdomains, the nonlinearity is localized to a small region. Computational time for groundwater pollution problems can be saved by the boundary element method; accurate numerical results can be obtained by the weighted finite difference method. The first example is the diffusion of an organic solvent through a porous medium. The groundwater flow equation is solved by BEM, and the convective dispersion equation is solved by WFDM, saving computer memory and computational time while maintaining accuracy. The second example is aquifer pollution by an industrial wastewater, assuming no difference in density between the wastewater and aquifer water. The solution is obtained by WFDM. The third example is also industrial wastewater, but in a concentration high enough to effect a density gradient. Both BEM and WFDM are used to obtain the solution. WFDM solutions to the problem of seawater intrusion into coastal aquifers are in good agreement with experimental results. (Tappert-PTT)
W91-06095

PATHWAY AND FATE OF THE HEAVY METAL MIXTURE IN XIAMEN MARINE EXPERIMENT ENCLOSURES.

National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
J. Li, R. Du, G. Zhang, C. S. Wong, and R. W. Macdonald.

Acta Oceanologica Sinica, Vol. 9, No. 3, p 389-403, 1990. 10 fig, 6 tab, 17 ref.

Descriptors: *Fate of pollutants, *Heavy metals, *Marine environment, *Marine sediments, *Path of pollutants, Cadmium, China, Copper, Lead, Mercury, Organic matter, Particulate matter, Phytoplankton, Sedimentation, Sediments, Xiamen Bay, Zinc, Zooplankton.

The pathway and fate of heavy metals were studied in 10-cu m enclosures in Xiamen Bay, China in 1985. The dissolved metals added were removed rather quickly during the first days, and their half-removal times were as follows: Pb 5.4-5.8, Hg 6.7-14, Zn 11-22, Cu 16-29, and Cd 30-89 days. Zinc is transferred biologically to particles during phytoplankton bloom. The main fate of added metals after 27 days is as follows: more than 80% Cd and 60% Cu remain in the dissolved phase, more than 60% Pb and 50% Hg transfer to settling sediment, while Zn is equally distributed in dissolved phase and settling sediment. The enclosure wall uptake was less than 2% of the total metals added. Organic materials play an essential role in the partition and transfer of heavy metals in the water column. Terrigenous and autochthonous particles show different affinities for different metals. Most heavy metals associate weakly with zooplankton. The binding of Cd, Pb, Zn, and Cu to the particles shows distinctive features related to the diagenetic alteration. (Author's abstract)
W91-06104

MAPS: A GIS FOR LAND RESOURCE MANAGEMENT IN MONTANA.
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 7C.
W91-06115

LEACHING CHARACTERISTICS OF CONSTRUCTION MATERIALS AND STABILIZATION PRODUCTS CONTAINING WASTE MATERIALS.
Netherlands Energy Research Foundation ECN, Petten.
For primary bibliographic entry see Field 5E.
W91-06136

LEACHING CHARACTERISTICS OF SELECTED ELEMENTS FROM COAL FLY ASH AS A FUNCTION OF THE ACIDITY OF THE CONTACT SOLUTION AND LIQUID/SOLID RATIO.
Netherlands Energy Research Foundation ECN, Petten.
For primary bibliographic entry see Field 5E.
W91-06138

STUDY OF TRITIUM RELEASE FROM ENCAPSULATED TITANIUM TRITIDE ACCELERATOR TARGETS.
Purdue Univ., Lafayette, IN. School of Health Sciences.
R. R. Landolt, and L. R. Bauer.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 251-256, 2 fig, 6 ref. US Department of Energy Thesis Research Program on Nuclear Waste Management Agreement No. ARGONDO 055958 and Institute of Nuclear Power Operations Agreement No. 052483.

Descriptors: *Path of pollutants, *Radioactive wastes, *Tritium, *Waste disposal, *Waste solidification, *Waste stabilization, Cements, Encapsulation, Gypsum, Leaching, Performance evaluation, Radioactive tracers, Titanium.

Titanium tritide accelerator targets were encapsulated in several types of waste disposal solidification media. The resulting monoliths were subjected to a standard leach testing procedure. A bare tritium target was also immersed in water and evaluated for tritium release. As anticipated, more tritium was released from the bare target than from the encapsulated targets, but not by a large factor. Of the encapsulated media tested, gypsum cement, coated and uncoated, performed slightly better than epoxy or microsilica cement. A gypsum encapsulated target was also tested in air, and its tritium release was compared with that of the gypsum cement encapsulated target which had been subjected to the leach test. Significantly more tritium was released from the specimen suspended in the air. The results indicate that tritium can move through these barrier materials and may be released from an encapsulated target exposed to water or air. (See also W91-06124) (Author's abstract)
W91-06145

LEACHING LOW-LEVEL RADIOACTIVE WASTE IN SIMULATED DISPOSAL CONDITIONS.
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
L. P. Buckley, N. B. Tosello, and B. L. Woods.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 330-342, 6 fig, 3 tab, 10 ref.

Descriptors: *Leaching, *Path of pollutants, *Radioactive waste disposal, *Radioactive wastes, *Simulation analysis, *Waste disposal, Canada, Chalk River, Geochemistry, Groundwater movement, Radionuclides, Saturated flow, Waste containment.

Leaching tests formally recognized by the International Atomic Energy Agency (IAEA) or by the American Nuclear Society (ANS) are used to evaluate the release of radioactivity from a waste form under idealized conditions. These conditions do not represent the reality of disposal requirements, where engineered barriers are in place to limit access of water and to retard migration of radionucleotides into the biosphere. A test program underway at Chalk River, Ontario is attempting to provide an understanding of the release and transport of radionucleotides under more realistic conditions. Preliminary results indicate that releases are suppressed at least by an order of magnitude when the effects of barriers in a repository failure are considered. However, migration mechanisms cannot be fully explained by classical concepts involving saturated flow. Research efforts now focus on measurements in an unsaturated reducing environment, the conditions which are expected to be found in a well designed repository. (See also W91-06124) (Author's abstract)
W91-06151

INFLUENCE OF HYDROLOGIC FACTORS ON LEACHING OF SOLIDIFIED LOW-LEVEL WASTE FORMS AT AN ARID-SITE FIELD-SCALE LYSIMETER FACILITY.
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5E.
W91-06153

EXPERIENCE ACQUIRED IN THE FIELD OF LONG-TERM LEACHING TESTS ON BLOCKS OF RADIOACTIVE WASTE.
CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
For primary bibliographic entry see Field 5E.
W91-06154

LARGE-SCALE DEMONSTRATION OF LOW-LEVEL WASTE SOLIDIFICATION IN SALTSTONE.
Du Pont de Nemours (E.I.) and Co., Philadelphia, PA. Marshall Labs.
For primary bibliographic entry see Field 5E.
W91-06155

FIELD TESTING OF WASTE FORMS USING LYSIMETERS.
Idaho National Engineering Lab., Idaho Falls. Biotechnology and Waste Management Programs.
For primary bibliographic entry see Field 5E.
W91-06156

DNA ADDUCTS IN MARINE MUSSEL MYTILUS GALLOPROVINCIALIS LIVING IN POLLUTED AND UNPOLLUTED ENVIRONMENTS.
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5C.
W91-06184

MICROBIOLOGICAL QUALITY OF SOURCE WATERS FOR WATER SUPPLY.
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W91-06195

TROPICAL SOURCE WATER.
Savannah River Lab., Aiken, SC. Environmental Sciences Div.
For primary bibliographic entry see Field 5F.
W91-06196

INVERTEBRATES AND ASSOCIATED BACTERIA IN DRINKING WATER DISTRIBUTION LINES.
Millipore Corp., Bedford, MA.
For primary bibliographic entry see Field 5F.
W91-06205

VIRUSES IN SOURCE AND DRINKING WATER.
Arizona Univ., Tucson. Dept. of Nutrition and Food Science.
For primary bibliographic entry see Field 5F.
W91-06212

INTERFACIAL GEOCHEMISTRY OF BARIUM IN SUSPENSION AND SEDIMENT FROM ZHUJIANG ESTUARY.
Academia Sinica, Guangzhou (China). South China Sea Inst. of Oceanology.
Z. Xiangfei, Z. Jianlu, L. Zhiqing, L. Ziquiang, and C. Kwanming.
Acta Oceanologica Sinica, Vol. 9, No. 2, p 247-254, 1990. 6 fig, 2 tab, 12 ref.

Descriptors: *Barium, *China, *Estuarine sediments, *Oil industry, *Path of pollutants, *Sediment analysis, *Water pollution sources, Chemical properties, Estuaries, Iron, Manganese, Oil pollution, Salinity, Sediments.

In oceans and inland waters of the world, the rate of oil exploration is increasing constantly, and barite is commonly used as a weighting agent in oil-well drilling mud. Studies on the geochemical behavior of Ba may provide an understanding of environmental impacts of marine oil exploration activities. Chemical forms of Ba were determined in samples of suspension and sediment from the Zhujiang Estuary, China. Total suspended Ba content was between 2.4 and 40.4 microgram/L, and existed primarily in the crystalline form (43.5%), and secondly in the Fe-Mn oxidative form (23.1%). The percentage of organic form was 14.8%, carbonated form was 11.1%, and exchangeable form was 7.4%. The total content of Ba in the sediment was between 158.6 and 48.0 microgram/g. The percentage of crystalline form was 78.4%, Fe-Mn oxidative form was 13.5%, and carbonate form was 8.2%. Organic and exchangeable forms were not detected. The study on the mechanism of interfacial movement suggested that the salinity range of 10 was the turning point for the varied distribution of Ba. The subsidence of crystalline form affected the decrease of Ba content in suspension. The decrease primarily took place in the salinity range lower than 10, which corresponded to the high value of Ba content in the sediment. The solid-solution exchange process was mainly influenced by the exchangeable, Fe-Mn oxidative and organic forms, and their variations were closely related to the non-conservative behavior of dissolved Ba. (Mertz-PTT)
W91-06220

FERTILITY OF DOMESTIC SEWAGE AND EUTROPHICATION IN ESTUARINE HARBOR.
Xiamen Univ. (China). Inst. of Environmental Science.
For primary bibliographic entry see Field 5C.
W91-06221

ACID RAIN.

Central Electricity Generating Board, London (England). Environmental Policy Dept.
A. J. Crane.
Journal of the Royal Society of Health JRSHDS, Vol. 110, No. 3, p 77-80, 1990. 3 fig.

Descriptors: *Acid rain, *Acid rain effects, *Air pollution, Acidic water, Acidity, Chemistry of precipitation, Environmental effects, Hydrogen ion concentration, Limestone, Scandinavia, Soil-water-plant relationships, Sulfur dioxide, Water pollution.

When coal is burned, sulfur is oxidized to sulfur dioxide. Chemical reactions in the atmosphere convert some of the sulfur dioxide into sulfuric acid that may subsequently come to earth in rain. The details of these conversion processes have only come to be understood in the last decade, but the knowledge that air pollution from coal burning could acidify rain probably dates from the 1870s. Acid rain, however, was not perceived as a major environmental threat until a century later. Unlike the problem of urban pollution, the effects of acid rain did not manifest themselves close to major sources of acid gas emissions. Rather, remoter, clean-air regions of Europe, principally Scandinavia, where the acidification of lakes and streams emerged as a major environmental issue in the early 1970s were affected. As research progressed, it became apparent that the interaction of rain with the soil was of crucial importance. Where the water flows over chalk and limestone, acidity will normally be completely neutralized and not give rise to any problems. In more acidic soils a process known as cation exchange begins to dominate the chemical reactions. Some of the hydrogen ions that give the rain its acid character are retained by the soil in exchange for soil-derived elements, such as calcium. This process reduces the acidity of the water draining through the soil and at the same time feeds the calcium to the streamwater. For this process to proceed, there has to be a mobile acid anion, like sulfate, to accompany the released calcium cations through the soil. This process has resulted in water unsuitable for fish and declining forests in some regions. As in the case of surface water acidification, scientific investigation of forest decline has revealed causal mechanisms and requirements for solutions more complex than originally suspected. (Mertz-PTT)
W91-06236

SOAK-AWAY SYSTEMS AND POSSIBLE GROUNDWATER POLLUTION PROBLEMS IN DEVELOPING COUNTRIES.

Obafemi Awolowo Univ., Ile-Ife (Nigeria). Dept. of Civil Engineering.
D. Olanrewaju.
Journal of the Royal Society of Health JRSHDS, Vol. 110, No. 3, p 108-112, 1990. 42 ref.

Descriptors: *Developing countries, *Groundwater pollution, *Sanitation, *Septic tanks, *Viruses, Coxsackie virus, Enteroviruses, Hydrogen ion concentration, Light effects, Organic matter, Sanitary wastewater, Temperature effects, Wastewater.

People in developing countries do not have adequate sanitation. The majority of people in urban areas use septic tanks and very often most of these septic tanks are not properly designed or are located too close to water supply and a cause contamination. Experiments have shown that fecal organisms do not travel any significant distance radially as a result of the concentration gradient. They are, however, carried with groundwater flow. The amount of sludge available for removal in a septic tank is not indicative of its efficiency in terms of viral population because of the peculiar dynamic property of viruses. Other liquid wastes, such as from the kitchen and laundry, can reduce retention time in the tank and serve as transport media for the pathogens. Viruses adsorb to soils and are negatively charged at most pH values. Moisture content is very important in the survival of viruses. The poliovirus type I and coxsackie-virus B-1 remain viable longer than the 24 hours retention period and may percolate into the groundwater. Temperature and organic matter in the wastewater will also influence viral survival. Other factors influencing survival include type of organism, type of soil, pH, sunlight, rain, degree of contamination, predation and antagonistic effects from the resident microbial flora of the soil. Adsorption is probably the predominant factor in virus removal by soil. Special consideration should be given to the siting and design of any septic tank system in order to avoid groundwater pollution. Septic tanks should be located at least 20 m away from water supply sources such as wells and springs. (Mertz-PTT)
W91-06238

EXPERIMENTAL MARINE ECOSYSTEM STUDY OF THE PELAGIC BIOGEOCHEMISTRY OF PENTACHLOROPHENOL.

Dobrocky Seatech Ltd., Sidney (British Columbia).
M. B. Yunker, F. A. Whitney, W. J. Cretney, and C. S. Wong.
Marine Environmental Research MERSDW, Vol. 30, No. 4, p 273-295, 1990. 5 fig, 3 tab, 35 ref. Environmental Contaminants Contract Funds contract 07SB.FP833-9-0943.

Descriptors: *Chlorinated hydrocarbons, *Fate of pollutants, *Marine pollution, *Water pollution effects, Aquatic life, Diatoms, Model studies, Photolysis, Phytoplankton, Primary production, Retention time, Water pollution, Zooplankton.

The marine biogeochemistry of pure pentachlorophenol was studied relative to a control treatment at a scale which provided a good model for the pelagic planktonic environment (70 cubic m polyethylene bags). Pentachlorophenol that was dispersed at concentrations of 10 and 100 microgram/L showed identical relative rates of decrease over 25 days to concentrations 32.8% for 10 microgram/L and 31.1% for 100 microgram/L of the initial concentrations. No bioaccumulation by phytoplankton or zooplankton was observed and pentachlorophenol removal by adsorption (by particulates, zooplankton or the enclosure walls) was insignificant. The log of the pentachlorophenol concentration was significantly correlated with the hours of bright sunshine up to day 18, after which the photolysis efficiency decreased as the proportion of pentachlorophenol exposed to sunlight decreased. The results imply a long residence time for pentachlorophenol in deeper waters outside the photolysis zone. A persistent reduction in the primary production and production per unit carbon was observed at 100 microgram/L and, when coupled to the demise of the centric diatom Skeletonema costatum in culture and the spiked enclosures, suggests that pentachlorophenol inhibits phytoplankton growth. (Author's abstract)
W91-06241

POLLUTANT DYNAMICS AS INFLUENCED BY SEAGRASS BEDS: EXPERIMENTS WITH TRIBUTYLTIN IN THALASSIA MICROCOSMS.

Cornell Univ., Ithaca, NY. Ecosystems Research Center.
S. N. Levine, D. T. Rudnick, J. R. Kelly, R. D. Morton, and L. A. Buttel.
Marine Environmental Research MERSDW, Vol. 30, No. 4, p 297-322, 1990. 3 fig, 10 tab, 20 ref. US EPA cooperative agreement CR812685, CR812685-02 and CR812685-03.

Descriptors: *Bioaccumulation, *Fate of pollutants, *Marine pollution, *Organotin compounds, *Path of pollutants, *Sea grasses, Degradation, Ecological effects, Food chains, Toxicants, Water pollution.

Seagrass beds are highly productive ecosystems whose leaves and sediments provide considerable surface area for interactions with seawater; thus, they may be foci for the sorption, accumulation and degradation of pollutants. The fate of the potent biocide tributyltin in water that passes through seagrasses and over sediments was studied in marine microcosms containing sediment cores from a subtropical seagrass bed (including Thalassia testudinum and associated fauna) and seawater. Over 3 or 6 weeks, 48 of these microcosms were dosed weekly for 24 hours with 14C-labelled tributyltin at three different doses (initial concentrations of 0.2, 2 and 20 microgram tributyltin/L) and flushed with flowing seawater between dose periods. The tributyltin was rapidly removed from the water column (half times of 10-20 hours), primarily through adsorption onto sediments and seagrass leaves. By contrast, 12 microcosms that received similar tributyltin doses but that contained only seawater had tributyltin removal half times of 2-7 days. Accumulation of tributyltin in sediments and grasses was temporary, however; at harvest, the seagrass microcosms contained just 20-30% of the 14C that had been adsorbed or assimilated during dose periods, and half of this label was in degradation products. The principal mechanism of tributyltin loss from solids was degradation followed by desorption of degradation products (largely monobutyltin and CO2, which are more soluble than tributyltin). Despite relatively rapid tributyltin degradation, tributyltin accumulated in fauna; at harvest, 2-6% of the 14C in microcosms was in invertebrates. Thus seagrass beds can be viewed as foci for the concentration of tributyltin, as processors of tributyltin to less toxic degradation products, and as vectors for distribution of tributyltin through coastal food chains. (Author's abstract)
W91-06242

CESIUM-137 IN THE GOIANIA WATERWAYS DURING AND AFTER THE RADIOLOGICAL ACCIDENT.

Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil).
J. M. Godoy, J. R. D. Guimaraes, J. C. A. Pereira, and M. A. Pires do Rio.
Health Physics HLTPAO, Vol. 60, No. 1, p 99-103, January 1991. 3 fig, 1 tab, 6 ref.

Descriptors: *Brazil, *Cesium radioisotopes, *Path of pollutants, *Radioactive wastes, *Radioactivity, *Water pollution sources, Bioaccumulation, Radiochemical analysis, Runoff, Sediment analysis, Suspended sediments, Water analysis, Water pollution.

One of the main environmental consequences of the Goiania, Brazil radiological accident was that a significant fraction of the 137Cs source was deposited on unprotected soil surfaces, which were exposed to wind and rain during the 3 weeks before remedial action was taken. Some 137Cs was introduced into the sewage system, but rainwater runoff, together with soil resuspension, was the main pathway for 137Cs migration out of the contamination areas. Since the Goiania sewage treatment system was still being constructed at the time of the accident, local rainwater and sewage were both drained to small creeks that are tributaries of the Meia-Ponte River. A survey of the sewage galleries near the main contamination areas, performed with portable scintillometers, indicated that 137Cs reached the Meia-Ponte River mainly through two small tributaries: The Capium Puba and Anicums Creeks. Regular measurements of bottom sediment, surface water, and fish were begun 3 weeks after the accident. In the first survey, 137Cs was detectable in sediments up to 12 km downstream from the accident area. Maximum 137Cs concentrations found in sediments of the Meia-Ponte River were 1.3 kilobequerel/kg dry weight and 200 bequerel/kg freshweight for fish. Cesium-137 was always $<$ 10 bequerel/L in surface waters plus suspended particulates, even in the most contaminated creeks. Because it was the beginning of the rainy season, downstream sediment transport was enhanced. This resulted in a decrease of 137Cs concentrations in sediments of the urban area by a factor of approximately 20, 5 weeks after the accident. The main sedimentation area for suspended sediments in this portion of the river is the Rochedo Reservoir, which is 80 km downstream from the accident area. In a survey performed 10 months after the accident, 137Cs concentrations in the reservoir were up to 14 bequerel/kg for fish, 1 bequerel/kg for aquatic plants, and 100 bequerel/kg dry weight for bottom sediments. (Mertz-PTT)
W91-06243

CARBON-14 TRACER STUDY OF POLYACRYLATE POLYMER IN A WASTEWATER PLANT.

Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 5D.

W91-06245

HYDROCARBON BIOACCUMULATION FROM CONTAMINATED SEDIMENT BY THE DEPOSIT-FEEDING POLYCHAETE ABARENICOLA PACIFICA.
Washington Univ., Seattle. School of Oceanography.
D. P. Weston.
Marine Biology MBIOAJ, Vol. 107, No. 1, p 159-169, 1990. 7 fig, 3 tab, 56 ref. US. EPA cooperative agreement CX-813705-01.

Descriptors: *Bioaccumulation, *Hydrocarbons, *Path of pollutants, Organic carbon, Organic matter, Polychaetes, Sediment contamination, Soil water pollution.

The role of the organic carbon content of sediment in aromatic hydrocarbon bioaccumulation and the importance of two routes of hydrocarbon uptake are assessed. The two routes include: (1) the uptake of the particulate contaminant fraction from ingested sediment; (2) the uptake of the dissolved contaminant fraction from interstitial or overlying water. The lugworm Abarenicola pacifica was collected from San Juan Island, Washington, in January 1989, and exposed to three sediments contaminated with (3H)benzo(a)pyrene. By manipulating the organic content of these sediments, it was possible to establish three treatments with similar (3H)benzo(a)pyrene concentrations in the interstitial water, but differing in the amount of (3H)benzo(a)pyrene in the bulk sediment. (3H)benzo(a)pyrene bioaccumulation over the first few days of exposure was correlated with feeding rate, suggesting that ingested sediments were a source of (3H)benzo(a)pyrene. The greatest body burden, however, was attained in those individuals held in sediments with the lowest organic carbon content and the lowest (3H)benzo(a)pyrene concentration. Body burden at steady state was not correlated with either (3H)benzo(a)pyrene concentrations in bulk sediment (dry weight or organic carbon-normalized bases) or the interstitial water. Increased organic matter decreased (3H)benzo(a)pyrene bioavailability in a non-linear fashion. Bioaccumulation factors relative to water and organic content were relatively constant between 1 and 2% organic carbon in the sediment, but these same accumulation factors substantially underestimated body burden if applied to sandy sediments with little organic carbon. (Author's abstract)
W91-06259

VARIATION IN COMPOSITION AND CONDITION OF THE PACIFIC OYSTER, CRASSOSTREA GIGAS, ALONG A POLLUTION GRADIENT IN MANUKAU HARBOUR, NEW ZEALAND.
Department of Scientific and Industrial Research, Hamilton (New Zealand). Water Quality Centre.
For primary bibliographic entry see Field 5C.
W91-06261

SE UPTAKE AND ACCUMULATION IN MARINE PHYTOPLANKTON AND TRANSFER OF SE TO THE CLAM PUDITAPES PHILIPPNARUM.
Xiamen Univ. (China). Dept. of Oceanography.
G. H. Zhang, M. H. Hu, and Y. P. Huang.
Marine Environmental Research MERSDW, Vol. 30, No. 3, p 179-190, 1990. 55 fig, 1 tab, 14 ref.

Descriptors: *Biological magnification, *Clams, *Diatoms, *Food chains, *Mollusks, *Path of pollutants, *Selenium, Environmental effects, Phytoplankton, Water pollution, Water pollution effects.

THe biomagnification of Se has been studied in freshwater food chains, but less in known about the transfer of Se within the marine food chain. Se uptake and accumulation in marine phytoplankton and the transfer of Se to the clam Puditapes philippnarum was studied. The accumulation of Se in three marine diatoms, Skeletonema costatum, Phaeodactylum tricornutum and Chaetoceros muelleri was rapid and concentration factors were generally >10,000. The accumulation of 75Se by the clam P. philippnarum was mainly from Se-labelled food (phytoplankton), with lesser amounts being accumulated directly from seawater. The clams assimilated Se from ingested phytoplankton with an assimilation coefficient of over 50%. When Se was accumulated via food, the largest amount of Se was in the soft tissues in the following order: viscera > gills > gonads > mantle > muscle. When Se accumulation was via seawater, Se was found mainly in or on the shell. The excretion kinetics of Se revealed two compartments. The short-lived compartment had a biological half-time of 8 days for small clams and 13 days for large clams, while for the long-lived compartment it was about 52 days for clams of both sizes. (Author's abstract)
W91-06262

COMPARISON OF THE ROLES OF DIRECT ABSORPTION AND PHYTOPLANKTON INGESTION IN ACCUMULATION OF CHROMIUM BY SEA URCHIN LARVAE.
Otago Univ., Dunedin (New Zealand). Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W91-06265

NATURAL RECOLONIZATION OF A CHRONICALLY OIL-POLLUTED MANGROVE SOIL AFTER A DE-POLLUTION PROCESS.
Montpellier-2 Univ. (France). Lab. d'Hydrobiologie Marine.
For primary bibliographic entry see Field 5G.
W91-06266

TRANSPORTED MATERIAL IN A SMALL RIVER WITH MULTIPLE IMPOUNDMENTS.
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2J.
W91-06272

CUBIC-SPLINE INTERPOLATION IN LAGRANGIAN ADVECTION COMPUTATION.
Tennessee Valley Authority, Norris. Engineering Lab.
G. A. Schohl, and F. M. Holly.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 248-253, February 1991. 3 fig, 7 ref.

Descriptors: *Advection, *Mathematical models, *Model studies, *Numerical analysis, *Path of pollutants, Solute transport, Stream pollution.

Lagrangian schemes for numerical approximation of contaminant advection are capable of providing satisfactory accuracy with minimal computational effort. This performance is achieved by exploiting the natural hyperbolicity of the advection operator, by which contaminant is advected from an earlier upstream position to the present downstream position along the characteristic trajectory followed by a contaminant particle. Excessive numerical damping (artificial diffusion) of the upwind difference method results because, after being recast as a Lagrangian method, it uses a simpler linear interpolation at the foot of the trajectory between two computational points. Use of a continuous cubic-spline interpolation function obviates the need to solve the auxiliary problem for the first derivative. The cubic-spline alternative to the Holly-Preissmann two-point fourth-order method offers nearly the same accuracy while achieving a measurable reduction in execution time and code size. The Lagrangian method for numerical approximation of the advection operator is clearly a powerful and accurate technique when combined with appropriate cubic interpolation at the foot of the characteristic trajectory. (Fish-PTT)
W91-06298

SWEET CORN YIELD AND TISSUE METAL CONCENTRATIONS AFTER SEVEN YEARS OF SEWAGE SLUDGE APPLICATIONS.
Oregon State Univ., Corvallis. Agricultural Experiment Station.
For primary bibliographic entry see Field 5E.
W91-06299

SOIL TYPE, PRECIPITATION, AND FERTILIZER N EFFECTS ON CORN YIELDS.
Wisconsin Univ.-Stevens Point. Coll. of Natural Resources.
For primary bibliographic entry see Field 3F.
W91-06302

NITRIFICATION AND NITRATE UPTAKE: LEACHING BALANCE IN A DECLINED FOREST ECOSYSTEM IN EASTERN FRANCE.
Centre de Pedologie Biologique, Vandoeuvre-les-Nancy (France).
T. Becquer, D. Merlet, J. P. Boudot, J. Rouiller, and F. Gras.
Plant and Soil PLSOA2, Vol. 125, No. 1, p 95-107, 1990. 1 fig, 6 tab, 42 ref. DEFORPA Program contract INRA/CEE No EV.4V.0014.F.

Descriptors: *Acid rain effects, *Air pollution effects, *Forest ecosystems, *Forest hydrology, *France, *Nitrification, Acidification, Calcium, Fir trees, Ion transport, Leaching, Magnesium, Nitrates, Potassium, Vegetation effects.

During the 1970s foresters and scientists observed serious defoliation in conifer stands of northern and central Europe and currently forest decline is a major problem in a large part of Europe and North America. Several hypotheses have been advanced to explain the decline, including atmospheric pollution, leaching of Ca, Mg, and K ions from foliage, and significant acidification due to the dry and wet deposition. Nitrate uptake and leaching were measured during one year in a declined fir forest on the Vosges highlands in eastern France, in order to investigate whether excess nitrification could be responsible for a deleterious acidification of the ecosystem. Nitrate uptake by the vegetation was active mainly from spring to early fall, and then reached about 66 kg N/ha. No significant leaching loss occurred during the growth period of the vegetation. Significant nitrate leaching occurred in winter (about 17 kg N/ha). During fall and winter the nitrification rate was of the same magnitude as values reported for other ecosystems, and, thus, was not considered to be abnormally strong. No abnormal temporal discoupling of nitrate production and nitrate uptake occurred in the ecosystem, and forest decline must therefore have some other cause. (Author's abstract)
W91-06308

NITRATE ACCUMULATION IN LEAVES OF VEGETATION OF A FORESTED ECOSYSTEM RECEIVING HIGH AMOUNTS OF ATMOSPHERIC AMMONIUM SULFATE.
Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W91-06309

CHEMICAL COMPOSITION OF SOIL SOLUTIONS EXTRACTED FROM NEW ZEALAND BEECH FORESTS AND WEST GERMAN BEECH AND SPRUCE FORESTS.
Forest Research Inst., Christchurch (New Zealand). Forest and Wildland Ecosystems Div.
M. R. Davis.
Plant and Soil PLSOA2, Vol. 126, No. 2, p 237-246, 1990. 1 fig, 5 tab, 16 ref.

Descriptors: *Acid rain effects, *Air pollution effects, *Forests, *Germany, *New Zealand, *Soil contamination, *Soil water, *Water pollution sources, Acid rain, Aluminum, Beech trees, Forest hydrology, Magnesium, Nitrates, Soil chemistry, Spruce trees, Sulfates.

A recent study comparing the concentrations of ionic compounds in rain and fog at two remote sites in the South Island, New Zealand, and at two sites in Bavaria, West Germany, indicated that the Bavarian area was impacted by air pollution, whereas in New Zealand, concentrations were generally very low. Concentrations of ions were measured in soil solutions from beech forests in

remote areas of New Zealand and in solutions from beech and Norway spruce forests in Bavaria to compare the soil solutions which are unaffected by acid deposition (New Zealand) with those that are affected (West Germany). In New Zealand, soil solution SO4(-2) concentrations ranged between <2 and 58 micromol/L, and NO3(-) concentrations ranged between <1 and 3 micromol/L. In West Germany, SO4(-2) concentrations ranged between 80 and 700 micromol/L, and NO3(-) concentrations at three of six sites ranged between 39 and 3750 micromol/L, but was not detected at the remaining three sites. At all sites in New Zealand, and at sites where the soil base status was moderately high in West Germany, pH levels increased, and total Al and inorganic monomeric Al levels decreased rapidly with increasing soil depth. In contrast, at sites on soils of low base status in West Germany, pH levels increased only slightly, and Al levels did not decline with increasing soil depth. Under a high-elevation Norway spruce stand showing severe Mg deficiency and dieback symptoms in West Germany, soil solution Mg(+2) levels ranged between 20 and 60 micromol/L, and were only half those under a healthy stand. Total Al and inorganic monomeric levels were substantially higher under the healthy stand than under the unhealthy stand, indicating that Al toxicity was not the main cause of spruce decline. (Fish-PTT)
W91-06316

PROTON CYCLE OF A DECIDUOUS FOREST ECOSYSTEM IN THE NETHERLANDS AND ITS IMPLICATIONS FOR SOIL ACIDIFICATION.
Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science.
J. M. Verstraten, J. C. R. Dopheide, J. J. H. M. Duysings, A. Tietema, and W. Bouten.
Plant and Soil PLSOA2, Vol. 127, No. 1, p 61-69, 1990. 2 fig, 3 tab, 22 ref.

Descriptors: *Acid rain effects, *Acidic soils, *Forest hydrology, *Ion transport, *Netherlands, *Soil chemistry, Acid rain, Acidic water, Acidification, Aluminum, Calcium, Forest ecosystems.

There has been considerable debate on the extent to which soil and water acidification is caused or accelerated by acidifying atmospheric deposition. From this debate the concept of the internal or external proton cycle has developed. The proton cycle gives information on the actual rate of acidification of the considered soil, ecosystem, or watershed. Investigations into the proton cycle of a forest ecosystem in the Netherlands revealed an intermediate rate of soil acidification: 4,500 keq/sq km/yr of which 2/3 is caused by external proton sources. The high retention of ammonia-nitrogen in the biomass is the dominant source of protons, and accounts for 90% of the external and for 59% of the total proton source, while atmospheric input of free acidity only accounts for 4% of total proton production. Next to this, calcium release by weathering is the main proton sink, accounting for 72% of total proton consumption. The proton transfer processes have caused very acid conditions of the upper soil horizons (pH 2.9-3.5) which resulted in the mobilization of aluminum as inorganic monomeric (toxic) aluminum up to maximum concentrations of 1500 micromol/L (40 mg Al(+3)/L). (Fish-PTT)
W91-06317

ACCELERATED NITROGEN INPUTS--A NEW PROBLEM OR A NEW PERSPECTIVE.
National Power, Leatherhead (England). Technology and Environmental Centre.
R. A. Skeffington.
Plant and Soil PLSOA2, Vol. 128, No. 1, p 1-11, 1990. 7 fig, 28 ref.

Descriptors: *Acid rain effects, *Europe, *Forest ecosystems, *Nitrates, *Nitrogen compounds, *Water pollution sources, Acid rain, Acidification, Air pollution effects, Ammonium, Dry deposition, Leaching, Nutrients.

There have been an increasing number of suggestions over the past few years that deposition of inorganic nitrogen compounds from the atmosphere is damaging forest ecosystems, in contrast to earlier views that atmospheric N deposition was a useful source of an essential, and often limiting, nutrient. There is some question whether new problems are arising in forest ecosystems due to increased levels of inorganic deposition from the atmosphere, or whether there are no new problems--just a change of perception. In order to make a rational assessment of the forest ecosystem effects, estimates of wet deposition of ammonium and nitrate ions in Europe were examined. It was corroborated that deposition of N has indeed increased. Wet deposition rates are reasonably quantified, but the rates of dry deposition to forests are largely unknown. Current transport and deposition models are probably under-estimating N deposition to forests. Consideration of possible effects of enhanced N deposition reveals with varying degrees of certainty that there may be effects due to high N in biomass, high uptake rates, leaching of nitrate and consequent acidification, and an overall increase in N availability. Forest ecosystems are not well-enough understood to set a 'critical load' for N deposition, but enough is known to define some upper limits. (Fish-PTT)
W91-06320

DISSOLVED INORGANIC NITROGEN CONCENTRATIONS AND FLUXES IN THREE BRITISH SITKA SPRUCE PLANTATIONS.
Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
P. A. Stevens, J. K. Adamson, B. Reynolds, and M. Hornung.
Plant and Soil PLSOA2, Vol. 128, No. 1, p 103-108, 1990. 1 fig, 1 tab, 19 ref.

Descriptors: *Acid rain effects, *England, *Forest ecosystems, *Nitrogen compounds, *Nitrogen cycle, *Soil-water-plant relationships, *Wales, *Water pollution sources, Acid rain, Ammonium, Canopy, Conifers, Leaching, Precipitation, Soil water, Spruce trees, Stemflow, Streams, Throughfall.

A number of studies have shown that ammonium is the dominant form of dissolved inorganic-N in the soils of British conifer plantations. Forest ecosystems are considered to conserve nitrogen, with leaching losses restricted by a tight nitrogen cycle, although there is increasing evidence that not all forests behave in this manner. A catchment approach was used to estimate mean dissolved inorganic-N concentrations and fluxes through three mature Sitka spruce plantations at Beddgelert in north Wales, Plynlimon in mid-Wales, and Kershope in Cumbria. Dissolved inorganic-N in bulk precipitation, throughfall, stemflow, soil water at 4 or 5 depths, and streamwater was measured every two weeks for periods of 1 or 2 years at all three sites. Bulk precipitation inputs at the three sites varied from 6 to 10.4 kg N/ha/a and stream outputs varied from 6.4 to 13.6 kg N/ha/a. Beddgelert Forest had the highest inputs and outputs and is 'nitrogen saturated' according to certain Scandinavian criteria. All three sites had much higher outputs than might be expected from the magnitude of the inputs, since conifer forests are normally regarded as being 'conservative' with respect to N. Only at Plynlimon were reductions in dissolved inorganic N flux or concentration observed from bulk precipitation to throughfall and soil waters. At the other two sites, the tree canopies did not assimilate N in incoming rainfall, and active nitrification resulted in high concentrations of nitrate in soil and streamwater. It is proposed that many mature western upland Sitka spruce plantations may behave in a similar manner with respect to dissolved N, in contrast to sites in eastern Scotland where rates of nitrification are slower and nitrogen appears to be less available to plantation trees. (Author's abstract)
W91-06323

BENZO(A)PYRENE METABOLISM IN ISOLATED PERFUSED RAINBOW TROUT GILLS.
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
T. Andersson, and P. Part.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 3-7, 1989. 1 fig, 2 tab, 10 ref.

Descriptors: *Benzopyrene, *Gills, *Metabolism, *Path of pollutants, *Polycyclic aromatic hydrocarbons, *Toxicology, *Trout, Biotransformation, Enzyme activity, Enzymes, Fish physiology, Metabolites, Toxicity.

The aquatic environment is increasingly polluted by polycyclic aromatic hydrocarbons. Fish gills are one route for absorption of these xenobiotics from the surrounding environment. The uptake, metabolism, and release of benzo(a)pyrene (BAP) in rainbow trout (Salmo gairdneri) gills was investigated. The concentration of BAP and BAP metabolites in the effluent perfusate reached a maximum value (1 pmol BAP/min) 25-40 min after the addition of BAP to the external water. The major fraction (50%) in the perfusate was glucoronidates BAP. The non-conjugated fraction consisted of unmetabolized BAP (81%) and 9,10-dihydrodiols, 7,8-dihydrodiols, 4,5-dihydrodiols, and quinones. Results show that rainbow trout gills contain active xenobiotic biotransformation enzyme systems which probably modify the absorption, toxicity, and fate of organic pollutants in the organism. (Author's abstract)
W91-06324

HYDROXYLATION OF PRISTANE BY ISOLATED HEPATOCYTES OF RAINBOW TROUT: A COMPARISON WITH IN VIVO METABOLISM AND BIOTRANSFORMATION BY LIVER MICROSOMES.
Laboratoire des Xenobiotiques, Toulouse (France).
J. P. Cravedi, E. Perdu-Durand, M. Bradat, and J. Tulliez.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 15-18, 1989. 1 fig, 1 tab, 9 ref.

Descriptors: *Biotransformation, *Fate of pollutants, *Liver, *Path of pollutants, *Pristane, *Toxicology, *Trout, Animal metabolism, Fish physiology, Hepatocytes, Microsomes, Model studies, Water pollution effects.

In vitro models may represent a useful approach for studying the biotransformation of xenobiotics in animals. However, the value of such models can only be established by relating in vitro results with in vivo data. In fish, several investigators have compared xenobiotic metabolism in vivo with xenobiotic metabolism in subcellular liver fraction, while, in contrast, the biotransformation of chemicals in isolated fish hepatocytes has been scarcely studied. In rainbow trout, the metabolism of a widespread branched alkane (pristane) in isolated hepatocytes was compared with metabolism in vivo and in liver microsomal fractions. The incubation of hepatocytes with tritiated pristane lead to pristanol, pristane-diol and pristanic acid, while pristanol appeared to be the only product in microsomal preparations. In the in vivo experiment, the liver contained significant amounts of pristanol and pristanic acid, and the bile contained conjugates of pristanol and pristane-diol. Thus, the metabolism of pristane in hepatocytes suspension correlates with in vivo biotransformation better than does metabolism in microsomes. Freshly isolated hepatocytes have proved to be a suitable system to investigate biotransformations of xenobiotics in fish. (Author's abstract)
W91-06325

MIXED-FUNCTION OXYGENASE SYSTEM AND BENZO(A)PYRENE METABOLISM IN ECHINODERMS.
Utrecht Rijksuniversiteit (Netherlands). Research Group for Aquatic Toxicology.
P. J. den Besten, and D. R. Livingston.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 19-23, 1989. 1 tab, 9 ref.

Descriptors: *Animal metabolism, *Benzopyrene, *Echinoderms, *Enzymes, *Mixed-function oxygenase, *Oxygenase, *Path of pollutants, *Toxicology, Comparison studies, Cytochromes, English Channel, Gonads, Stomach, Tissue analysis.

The mixed-function oxygenase (MFO) system is an apparently universally distributed enzyme system, found also in marine invertebrates. A comparative

study on the presence of a mixed-function oxygenase (MFO) system was carried out on four echinoderm species (collected in the English Channel near Plymouth, England): the asteroids Asterias rubens and Marthasterias glacialis, an echinoid Echinus esculentus and a holothurian Holothuria forskali. After dissection, tissue samples were homogenized, centrifuged, and resuspended. Cytochrome P-450 and cytochrome b5 contents and reductase activity were analyzed spectrophotometrically and benzo(a)pyrene hydroxylase (BPH) was determined fluorometrically; protein was also assayed. In A. rubens the tissue and subcellular distribution of MFO compounds was also investigated. Cytochromes P-450 and b5 and the MFO system-associated NADH-ferricyanide reductase, NADH-cytochrome c reductase, NADPH-cytochrome c reductase and BPH activities could be demonstrated in A. rubens (stomachs, pyloric caeca and gonads), M. glacialis (pyloric caeca), and H. forskali (hemal plexus) but in E. esculentus (gonads) no P-450 or BPH activity could be found. (Brunone-PTT)
W91-06326

POLYCHLORINATED BIPHENYLS CONCENTRATION AND CYTOCHROME P-450E EXPRESSION IN WINTER FLOUNDER FROM CONTAMINATED ENVIRONMENTS.
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
A. A. Elskus, J. J. Stegeman, L. C. Susani, D. Black, and R. J. Pruell.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 25-30, 1989. 1 fig, 1 tab, 15 ref. EPA Grant CR813155 and US PHS Grant ES04220.

Descriptors: *Cytochromes, *Ethoxy-resorufin O-deethylase, *Fish physiology, *Flounders, *Path of pollutants, *Polychlorinated biphenyls, *Toxicology, *Water pollution effects, Animal metabolism, Catalysis, Enzymes, Gas chromatography, Hydrocarbons, Immunoassay, Liver, Massachusetts.

Reproductively mature winter flounder (Pseudopleuronectes americanus) were collected from three northeastern US sites with different degrees of polychlorinated biphenyl (PCB) and polynuclear aromatic hydrocarbon (PAH) contamination. Liver PCB concentrations (measured by capillary electron-capture gas chromatography) in fish collected in 1987 and 1988 at New Bedford Harbor (NBH) ranged from 7.4 to 191 microg/g dry weight; at Gaspee Point 3.9 to 17.7 microg/g; and at Fox Island 1.6 to 15.1 microg/g. Levels of ethoxy-resorufin O-deethylase (EROD) activity were similar in fish of the same reproductive status from the three sites; however, immunoquantitated P-450E homolog (the EROD catalyst) content was significantly higher in NBH fish, suggesting that P-450E catalytic activity is being suppressed in the livers of the NBH animals. Recent laboratory studies indicate that competitive inhibition of P-450E catalytic activity by specific PCB congeners is one likely mechanism of this suppression. Hepatic EROD activity and P450-E content were significantly lower in gravid females than in spent females and ripe males at all sites. The results indicate a complex relationship between levels of EROD activity, or P-450E, and tissue PCB concentrations in highly contaminated fish. (Author's abstract)
W91-06327

MIXED-FUNCTION OXIDASE ACTIVITY AND CONJUGATING ENZYMES IN TWO SPECIES OF ANTARCTIC FISH.
Siena Univ. (Italy). Dipt. di Biologia Ambientale.
S. Focardi, C. Fossi, C. Leonzio, and P. Di Simplicio.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 31-33, 1989. 2 tab, 8 ref.

Descriptors: *Antarctica, *Baseline studies, *Biotransformation, *Enzymes, *Fish physiology, *Mixed-function oxidase, *Oxidase, *Path of pollutants, *Toxicology, Animal metabolism, Contamination, Detoxification, Liver, Peroxidases.

The mixed-function oxidase system and conjugating enzymes are the two most important multienzymatic systems involved in the metabolism and detoxification of xenobiotic compounds. Enzyme activities of phase I and phase II of the hepatic detoxication system were investigated in two species of fish (Pagothenia bernacchii and chiandraco hamature) from the Ross Sea in Antarctica, distant from sources of industrial and/or agricultural contamination. The fish had extremely low phase I enzyme (benzo(a)pyrene monooxygenase and aldrin epoxidase). The reductase regenerating enzyme activities were comparable to those found in fish of temperate seas. Transferases of cytosol showed highest activity in the conjugation of 1-chloro-2,4-dinitrobenzene and little or no conjugation of other substrates. The glutathione disulfide reductase and the glutathione transferase with peroxidase activity were low; the selenium-dependent glutathione peroxidase activity was not detectable. Interspecific differences were found for most enzymes. These results provide information about basal levels of enzymatic detoxication systems in marine organisms distant from sources of anthropogenic contamination. (Brunone-PTT)
W91-06328

SEASONAL VARIATION OF MIXED-FUNCTION OXIDASE ACTIVITY IN A POPULATION OF YELLOW-LEGGED HERRING GULL: RELATIONSHIP TO SEXUAL CYCLE AND POLLUTANTS.
Siena Univ. (Italy). Dipt. di Biologia Ambientale.
For primary bibliographic entry see Field 5C.
W91-06329

EVALUATION OF BIOCHEMICAL RESPONSES TO ENVIRONMENTAL CONTAMINANTS IN FLATFISH FROM THE HVALER ARCHIPELAGO IN NORWAY.
Bergen Univ. (Norway). Dept. of Biochemistry.
For primary bibliographic entry see Field 5C.
W91-06331

INDUCTION OF CYTOCHROME P-450E (P-450IA1) BY 2,3,7,8-TETRACHLORODIBENZOFURAN (2,3,7,8-TCDF) IN THE MARINE FISH SCUP (STENOTOMUS CHRYSOPS).
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W91-06332

ACCUMULATION AND BIOTRANSFORMATION OF AN ORGANOPHOSPHORUS PESTICIDE IN FISH AND BIVALVES.
Virginia Inst. of Marine Science, Gloucester Point.
R. C. Hale.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 67-71, 1989. 2 tab, 6 ref.

Descriptors: *Bioaccumulation, *Biotransformation, *Fish physiology, *Killifish, *Organophosphorus pesticides, *Oysters, *Path of pollutants, *Toxicology, Animal metabolism, Bivalves, Estuaries, Pesticides, Sediment chemistry, Sediment contamination, Water chemistry.

O-2,4-dichlorophenyl-O,O-diethylphosphorothioate (DCDEP), an organophosphorus pesticide, has been detected in indigenous estuarine shellfish near a manufacturing facility. A laboratory study to determine its disposition in Atlantic oysters (Crassostrea gigas) and sheepshead minnows (Cyprinodon variegatus) was subsequently undertaken. Oysters and fish were exposed to radiolabeled DCDEP and an unlabeled monochlorinated analog (MCDEP) via laboratory contaminated bottom sediment. Sediments were allowed to equilibrate for 28 days, prior to introduction of the test species. Organisms were transferred to clean water after 28 days of exposure and allowed to depurate for 14 days. Sediment, water and biological tissues were periodically collected and analyzed. MCDEP was detected in the water at higher concentrations than DCDEP. Oysters accumulated greater concentrations of DCDEP; fish accumulated similar amounts of MCDEP and DCDEP. Both compounds partitioned preferentially into lipid rich tissues. Oxidized transformation products were detected in the water and fish in higher proportions, relative to the parent compounds, than in the sediments or oysters. (Author's abstract)
W91-06333

INDUCTION OF THE HEPATIC MICROSOMAL MIXED-FUNCTION OXYGENASE (MFO) SYSTEM OF ALLIGATOR MISSISSIPPIENSIS BY 3-METHYLCHOLANTHRENE (3-MC).
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
For primary bibliographic entry see Field 5C.
W91-06334

PURIFICATION AND PROPERTIES OF HEPATO-PANCREAS AND GREEN GLAND CYTOSOLIC GLUTATHIONE S-TRANSFERASES OF THE RED SWAMP CRAYFISH, PROCAMBARUS CLARKII.
Louisiana State Univ., Baton Rouge. Dept. of Biochemistry.
For primary bibliographic entry see Field 5C.
W91-06335

METABOLISM AND ACCUMULATION OF XENOBIOTICS WITHIN HEPATO-PANCREAS CELLS OF THE BLUE CRAB, CALLINECTES SAPIDUS.
Skidaway Inst. of Oceanography, Savannah, GA.
R. F. Lee.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 93-97, 1989. 2 tab, 11 ref.

Descriptors: *Animal metabolism, *Bioaccumulation, *Crabs, *Hepatopancreas, *Path of pollutants, *Radioactivity techniques, *Toxicology, Benzopyrene, Chlorinated hydrocarbons, Glutathione S-transferases, Juvenile growth stage, Metabolites, Organotin compounds.

A number of carbon-14 labeled xenobiotics were added to the food of juvenile male blue crabs. After various times, the hepato-pancreas was removed and either different cell types (R-cells, F-cells, or B-cells) were isolated or the whole tissue was homogenized followed by isolation of nuclear, mitochondrial, microsomal, and cytosolic fractions. For poorly metabolized compounds, e.g. hexachlorobiphenyl, most radioactivity was in the lipid of R-cells. For compounds which were metabolized, e.g. benzo(a)pyrene, pentachlorophenol, chlorobenzoic acid, most radioactivity was in the F-cells in the form of conjugates of various metabolites. A significant amount of benzo(a)pyrene and tributyltin metabolites bound to macromolecules of the various fractions. When cytosol containing bound benzo(a)pyrene metabolites was passed down a Sephadex G-200 column, much of the bound radioactivity was associated with the glutathione S-transferase peak. (Author's abstract)
W91-06336

BLEACHED KRAFT PULPMILL EFFLUENTS AND TCDD: EFFECTS ON BIOTRANSFORMATION AND TESTOSTERONE STATUS OF MATURE MALE RAINBOW TROUT (SALMO GAIRDNERI).
Kuopio Univ. (Finland). Dept. of Physiology.
For primary bibliographic entry see Field 5C.
W91-06337

HYDROCARBON CONTENT AND MICROSOMAL BPH AND REDUCTASE ACTIVITY IN MUSSEL, MYTILUS SP., FROM THE VENICE AREA, NORTH-EAST ITALY.
Istituto di Biologia del Mare, Venice (Italy).
For primary bibliographic entry see Field 5C.
W91-06339

EXPRESSION OF ORTHOLOGUES TO RAT P-450IA1 AND IIB1 IN SEA-BIRDS FROM THE IRISH SEA 1987-88: EVIDENCE FOR ENVIRONMENTAL INDUCTION.
Karolinska Inst., Stockholm (Sweden). Dept. of Physiological Chemistry.
For primary bibliographic entry see Field 5C.

W91-06342

COMPARATIVE METABOLISM OF BENZO(A)PYRENE AND (-) BENZO(A)PYRENE-7,8-DIHYDRODIOL BY HEPATOCYTES ISOLATED FROM TWO SPECIES OF BOTTOM-DWELLING FISH.
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
For primary bibliographic entry see Field 5C.
W91-06344

CADMIUM ACCUMULATION AND METALLOTHIONEIN-LIKE PROTEINS IN THE SEA STAR ASTERIAS RUBENS.
Utrecht Rijksuniversiteit (Netherlands). Research Group for Aquatic Toxicology.
P. J. den Besten, H. J. Herwig, D. I. Zandee, and P. A. Voogt.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 163-166, 1989. 2 fig, 1 ref.

Descriptors: *Bioaccumulation, *Cadmium, *Echinoderms, *Metallothioneins, *Path of pollutants, *Proteins, *Toxicology, Animal tissues, Marine animals, Molecular weight, Saturation kinetics, Trace metals, Wadden Sea.

Sea stars Asterias rubens, collected from the Dutch Wadden Sea, were exposed to cadmium (50 microg cadmium(2+)/L) for 4 months. Accumulation rates were highest in body wall and pyloric caeca, while in the gonads a relatively low accumulation rate was measured. In all tissues, cadmium accumulation showed saturation kinetics. In the cytosolic fraction of pyloric caeca from cadmium-exposed sea stars, cadmium-binding proteins with a molecular weight of approximately 10,800 Da was shown. In cytosolic fractions of testes or ovaries, low molecular weight metal-binding proteins were absent and the accumulated cadmium was bound to high molecular weight proteins. As compared with other marine invertebrates, sea stars accumulate relatively low amounts of cadmium. (Author's abstract)
W91-06345

METAL-BINDING IN POLYCHAETES: QUANTITATIVE AND QUALITATIVE STUDIES OF FIVE SPECIES.
Oslo Univ. (Norway). Dept. of Biology.
K. D. H. Eriksen, T. Andersen, J. S. Gray, J. Stenersen, and R. A. Andersen.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 167-171, 1989. 2 tab, 10 ref.

Descriptors: *Animal metabolism, *Copper, *Heavy metals, *Nickel, *Path of pollutants, *Polychaetes, *Toxicology, *Zinc, Atomic absorption spectrometry, Comparison studies, Electrophoresis, Metallothioneins, Norway, Sediment chemistry.

Polychaetes normally comprise 70 to 90% of the total macrofauna in soft-bottom communities, both with regard to numbers and biomass. Many polychaete species are also of economic importance as food for benthic fish. The binding of metals in polychaetes and how it related to ambient metal levels was investigated. Polychaete and sediment samples were taken in a metal-contaminated coastal area close to Kristiansand, southern Norway. Crude extracts were prepared from each of the five selected polychaete species, and aliquots subsequently applied to a Sephadex G-75 column. The collected fractions were pooled according to molecular size and analyzed for copper, zinc, and nickel by atomic absorption spectrometry (AAS). Extracts from each of the species were also subjected to polyacrylamide electrophoresis. Copper in the extracts was primarily associated with components of high and very low molecular weight but also with proteins of size similar to mammalian metallothionein. Zinc was mainly recovered in the high molecular weight pool (>35kDa), whereas most of the nickel present eluted with very low molecular weight components. The metal content of pooled fractions was found to reflect sediment levels to some extent, but this situation was most evident at the moderately contaminated sites. Results from SDS-PAGE suggested the presence of metallothionein-like proteins in at least two of the species investigated. (Author's abstract)
W91-06346

FISH METALLOTHIONEINS: MOLECULAR CLONING STUDIES AND INDUCTION IN CULTURED CELLS.
Stirling Univ. (Scotland). Inst. of Aquaculture.
For primary bibliographic entry see Field 5C.
W91-06347

RELATIONSHIP BETWEEN METALLOTHIONEIN, COPPER AND ZINC IN PERCH (PERCA FLUVIATILIS) ENVIRONMENTALLY EXPOSED TO HEAVY METALS.
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
C. Hogstrand, G. Lithner, and C. Haux.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 179-182, 1989. 1 fig, 1 tab, 5 ref.

Descriptors: *Copper, *Heavy metals, *Metallothioneins, *Path of pollutants, *Perch, *Toxicology, *Zinc, Bioassay, Bioindicators, Correlation analysis, Environmental effects, Gel filtration, Liver.

Few biochemical methods exist for detecting effects of contaminants in fish that fulfil basic criteria demanded for such methods. Hepatic levels of copper, zinc and metallothionein (MT) in perch, caught in a copper/zinc gradient from a brassworks, reflected the water concentrations of copper (1.0 to 9.4 ppb) and zinc (0.56 to 59 ppb). Significant correlations were found between hepatic copper and MT levels ($r = 0.72$), and between zinc and MT levels ($r = 0.69$). The amounts of copper and zinc in the cytosolic fraction of the liver was increased with increased hepatic levels of the metals. When liver samples from perch caught at the most contaminated location were run on a gel filtration column (Sephadex G-75), 78% of the cytosolic copper and 24% of the zinc in the cytosol eluted together with MT. These results contribute to the understanding of copper and zinc metabolism in fish and increase the potential of MT as an indicator of heavy metals in water. (Author's abstract)
W91-06348

COMPARISON OF METAL-BINDING PROTEINS AND CADMIUM METABOLISM IN THE MARINE MOLLUSCS LITTORINA LITTOREA (GASTROPODA), MYTILUS EDULIS AND MACOMA BALTHICA (BIVALVIA).
Plymouth Marine Lab. (England).
W. J. Langston, M. J. Bebianno, and M. Zhou.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 195-200, 1989. 2 fig, 5 ref. Department of the Environment Grant PECD 7/7/335.

Descriptors: *Animal metabolism, *Bivalves, *Cadmium, *Gastropods, *Path of pollutants, *Proteins, *Toxicology, Comparison studies, Digestive gland, Marine pollution, Molecular weight, Polarography, Trace metals.

In Littorina littorea collected from uncontaminated sites, cadmium is predominantly bound to metallothionein (MT)-like proteins. Exposure to cadmium results in an increase in cadmium bound to these proteins, with limited increases in cadmium in the high molecular weight (HMW) pool (the latter partly as a result of hemocyanin-mediated transport of cadmium in the hemolymph). Polarographic determination of heat-stable MT-like compounds in L. littorea shows little increase in the amount of protein produced in response to cadmium exposure, suggesting that much of the newly incorporated metal may be bound to previously synthesized material. Relatively high levels of MT-like proteins in the digestive gland (the major cadmium-storage organ) appear to be inherent in this species. MT-like proteins also sequester much of the cadmium in exposed mussels (Mytilus edulis); though, unlike Littorina, protein induction can be quantitatively related to exposure. In contrast, tellinid clams, Macoma balthica, fail to produce MT-like compounds, even in highly contaminated conditions, and cadmium is mainly bound to HMW proteins. Variations in metal-binding behavior help explain interspecific differences in experimentally-determined cadmium uptake rates and bioaccumulation potential seen in the field. (Author's abstract)
W91-06350

METALS IN GASTROPODS--METABOLISM AND BIOREDUCTION.
Plymouth Marine Lab. (England).
J. A. Nott, and A. Nicolaidou.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 201-205, 1989. 1 fig, 1 tab, 6 ref. EEC Stimulation Programme Twinning Contract No. STJ-0046-01-UK (-02-GR)T.T.

Descriptors: *Animal metabolism, *Bioaccumulation, *Bioreduction, *Cytology, *Gastropods, *Heavy metals, *Path of pollutants, *Toxicology, Atomic absorption spectrometry, Magnesium, Mediterranean Sea, Radiography, Ultrastructure, X-rays.

The cytology of metal uptake by three kinds of marine gastropod (Cerithium vulgatum, Monodonta spp, and Murex trunculus) has been examined in animals taken from two sites in the Mediterranean, one clean and the other polluted with metals originating from a nickel smelting plant. In marine gastropods, high concentrations of heavy metals can occur in the digestive gland. The metals are accumulated within intracellular mineralized granules as phosphates and within lysosomal residual bodies in association with sulfur. X-ray microanalysis shows that in the phosphate granules, an increase in the quantity of metals is associated with a reduction in the magnesium/calcium ratio. However, analyses of the whole digestive gland by atomic absorption spectrometry shows that an increase in the quantity of metal can be associated with an increase in the concentration of magnesium. To account for these changes, metals may induce the formation of magnesium phosphate in the granules as a source of metal-binding ions. The excess magnesium is displaced from the phosphate granules by the metals and accumulated by the carbonate granules in the interstitial region of the gland. The intracellular metals are stored in a form which renders them unavailable to the general metabolic processes of the animal and also to a carnivore which eats the tissue. Thus, uptake by the first animal results in bioamplification but transfer to the second animal results in bioreduction. (Author's abstract)
W91-06351

STRATEGIES OF TRACE METAL SEQUESTRATION IN AQUATIC ORGANISMS.
Mott MacDonald Group, Croydon (England).
D. J. H. Phillips, and P. S. Rainbow.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 207-210, 1989. 1 fig, 7 ref.

Descriptors: *Animal metabolism, *Aquatic animals, *Bioaccumulation, *Detoxification, *Path of pollutants, *Sequestration, *Toxicology, *Trace metals, Bioindicators, Calcium, Copper, Hepatopancreas, Iron, Kidneys, Toxicity, Zinc.

Existing strategies for the sequestration of trace metals probably evolved through a need to detoxify and (at times) store major ions such as calcium, and metals of vital physiological function such as copper, iron, and zinc. Several types of strategies exist in different phyla and species, and organisms lie on a continuum from regulators of metals to non-regulators. Regulators balance metal excretion and influx over a large range in ambient availabilities. Metals are stored by partial regulators in soluble forms such as metallothioneins, found principally in the hepato-pancreas and kidney. By contrast, non-regulators rely more on insoluble granules for metal storage. Such sequestration strategies are important in defining both the toxicities of metals to aquatic biota and the use of organisms as biomonitors of aquatic pollution by trace elements. (Author's abstract)
W91-06352

CONVERGENCE OF CELLULAR SYSTEMS OF METAL DETOXIFICATION.
Reading Univ. (England). Dept. of Pure and Applied Zoology.
K. Simkiss, and M. G. Taylor.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 211-214, 1989. 2 fig, 12 ref. Science and Engineering Research Council Grant GR D 39221.

Descriptors: *Bioaccumulation, *Cytology, *Detoxification, *Heavy metals, *Metabolism, *Path of pollutants, *Toxicology, Animal metabolism, Excretion, Orthophosphates, Phosphates, Pyrophosphates.

A large number of organisms possess an intracellular system that is involved in the formation of inorganic granules. These granules are typically phosphatic, formed in membrane-enclosed regions and act as sites for the accumulation of a wide range of metals. There are two types of phosphatic granule: (1) those in which the anion is mainly pyrophosphate and (2) these which have a high concentration of orthophosphate with little pyrophosphate. The cells that form these deposits are able to extrude them and thus excrete the metals from the animal. The mechanisms involved in this detoxification route are shown to involve a number of convergent pathways. These granules may have more general functions as exocytosis routes for removing a variety of pollutant metals. (Author's abstract)
W91-06353

BIOCONCENTRATION AND ELIMINATION OF TRIPHENYLTIN HYDROXIDE IN FISH.
Utrecht Rijksuniversiteit (Netherlands). Research Inst. of Toxicology.
J. W. Tas, J. L. M. Hermens, M. Van den Berg, and W. Seinen.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 215-218, 1989. 2 tab, 5 ref.

Descriptors: *Animal metabolism, *Bioaccumulation, *Elimination, *Fish physiology, *Fungicides, *Organotin compounds, *Path of pollutants, *Toxicology, *Triphenyltins, Carbon radioisotopes, Concentration ratios, Equilibrium, Guppies, Herbicides, Kinetics, Trout.

The bioconcentration and elimination of carbon-14 radiolabeled triphenyltin hydroxide (TPTH), an active agent for the control of potato and sugar beet blight, was studied in two fish species: guppy (Poecilia reticulata) and rainbow trout (Salmo gairdneri) larvae. Uptake and elimination rate constants (k1 and k2) were estimated, assuming first-order kinetics. For the guppy, k1 and k2 were estimated to have a value of 2.94 +/-0.33 ml/g/hr and 0.0002 +/-0.0012/hr, respectively. For the rainbow trout larvae these numbers were 0.87 +/-0.13 ml/g/hr and .0013 +/-0.0003/hr, respectively. The ratios between concentrations of TPTH in fish and water at the end of the period of exposure were 632 ml/g for guppy after 8 days of exposure, and 82 ml/g for rainbow trout after 4 days of exposure. Since equilibrium was not reached in either experiment, these concentration ratios underestimate the real bioconcentration factor. (Author's abstract)
W91-06354

ALTERATION OF CALCIUM TRANSPORT AS A MECHANISM OF CELL INJURY INDUCED BY HGCL2 IN SEA URCHIN EGGS.
Centre Scientifique de Monaco, Monte Carlo.
For primary bibliographic entry see Field 5C.
W91-06355

MATERNAL TRANSFER OF BIOACTIVE POLYCHLORINATED AROMATIC HYDROCARBONS IN SPAWNING CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA).
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
G. T. Ankley, D. E. Tillitt, and J. P. Giesy.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 231-234, 1989. 1 fig, 10 ref.

Descriptors: *Fish physiology, *Hydrocarbons, *Path of pollutants, *Polychlorinated aromatic hydrocarbons, *Salmon, *Spawning, *Toxicology, Bioassay, Dioxins, Enzymes, Ethoxy-resorufin O-deethylase, Great Lakes, Maternal transfer, Polychlorinated biphenyls, Polychlorinated dibenzofurans, Reproduction.

Numerous studies have established the presence of significant concentrations of polychlorinated biphenyls, polychlorinated dibenzofurans, and polychlorinated dibenzodioxins in fishes from the Laurentian Great Lakes. In recent years, Lake Michigan chinook salmon (Oncorhynchus tschawytscha) have experienced significan reproductive difficulty, and evidence suggests that this lack of reproductive success may be due to planar polychlorinated aromatic hydrocarbons (PCHs). The biological potency (relative to 2,3,7,8-tetrachlorodibenzo-p-dioxin, TCDD) of planar PCHs in extracts of eggs and flesh from spawning female chinook salmon from Lake Michigan was determined by measuring the induction of 7-ethoxyresorufin O-deethylase activity in H-4-11-E rat hepatoma cells. TCDD-equivalents in flesh and egg samples ranged from 0 to 115.8 pg/g, and were approximately five times greater in eggs than in flesh. These results suggest that the maternal transfer of PCHs may help determine the reproductive success of Lake Michigan chinook salmon. Overall, this study clearly demonstrates the utility of the H-4-11-E bioassay for monitoring studies aimed at determining the presence and biological potency of complex mixtures of PCHs in environmental samples. (Brunone-PTT)
W91-06356

UPTAKE AND TRANSFORMATION OF 14C-LABELLED TRIBUTYLTIN CHLORIDE BY THE DOG-WHELK, NUCELLA LAPILLUS: IMPORTANCE OF ABSORPTION FROM THE DIET.
Plymouth Marine Lab. (England).
G. W. Bryan, P. E. Gibbs, L. G. Hummerstone, and G. R. Burt.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 241-245, 1989. 2 fig, 11 ref. Department of the Environment Contract PECD 7/8/103.

Descriptors: *Absorption, *Antifoulants, *Biotransformation, *Fate of pollutants, *Gastropods, *Organotin compounds, *Path of pollutants, *Toxicology, Biodegradation, Carbon radioisotopes, Concentration time, Disturbance, Food chains, Prediction.

The importance of the diet as a source of tributyltin (TBT) in Nucella lapillus was studied using carbon-14 labeled TBT chloride. In N. lapillus provided with pre-labeled mussels, Mytilus edulis, in labeled water (mean 20.5 ng/L TBT) the rate of accumulation of total carbon-14 was 2 to 3 times that in unfed animals. Owing to its degradation in the tissues of both fed and unfed animals, concentrations of carbon-14 labeled TBT tended to reach a plateau after only 28 days. However, total concentrations of carbon-14 were still increasing after 49 days. Under experimental conditions (15 C, ample food, no disturbance) the diet accounted for about 50% of the body burden of TBT in N. lapillus after 49 days exposure: concentration factors (dry tissue/water) for carbon-14 labeled TBT in both male and female N. lapillus were similar at about 60,000 in fed and 30,000 in unfed animals. The diet may contribute less than half of the body burden of TBT found in natural populations subjected to life-long exposure. (Author's abstract)
W91-06358

MERCURY INHIBITS THE TRANSPORT OF D-GLUCOSE BY THE INTESTINAL BRUSH BORDER MEMBRANE VESICLES OF FISH.
Rutgers - The State Univ., Piscataway, NJ. Nelson Biological Lab.
For primary bibliographic entry see Field 5C.
W91-06359

RELATIONSHIP BETWEEN LIPID COMPOSITION AND SEASONAL DIFFERENCES IN THE DISTRIBUTION OF PCBS IN MYTILUS EDULIS L.
Woods Hole Oceanographic Institution, MA.
J. M. Capuzzo, J. W. Farrington, P. Rantamaki, C. H. Clifford, and B. A. Lancaster.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 259-264, 1989. 2 fig, 10 ref. NOAA Sea Grant NA 86-AA-D-S6090 (RP/22 and RP/17); US EPA CR-814895-01-1.

Descriptors: *Animal metabolism, *Buzzards Bay, *Lipids, *Path of pollutants, *Polychlorinated biphenyls, *Sea mussels, *Toxicology, Bioacccumulation, Contamination, Massachusetts, Nantucket Sound, Reproduction, Seasonal variation.

The concentrations of individual chlorobiphenyl congeners were measured in the mussel Mytilus edulis transplanted to several stations in Buzzards Bay and Nantucket Sound, Massachusetts. Individual stations represented a gradient of chemical contamination and the sampling period extended over a complete annual cycle. Fluctuations in concentrations of some chlorobiphenyl congeners were apparent at all stations during the late spring and early summer with a marked decline occurring during autumn; this pattern was correlated with the seasonal cycle of gametogenesis and spawning activity. Relative redistribution and release of individual chlorobiphenyl congeners associated with spawning is not consistent, suggesting differential partitioning of specific congeners in different tissues or lipid pools. These patterns are consistent with bioconcentration of organic contaminants in marine organisms. The major factors controlling the distribution of polychlorinated biphenyls in mussels appear to be the relative concentrations of individual contaminants in ambient waters, modified to some extent by differences in partitioning between organisms and water and seasonal variations in lipid content. (Author's abstract)
W91-06360

TROPHIC TRANSFER OF BENZO(A)PYRENE METABOLITES BETWEEN BENTHIC MARINE ORGANISMS.
Massachusetts Univ. at Boston. Environmental Science Program.
A. E. McElroy, and J. D. Sisson.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 265-269, 1989. 2 fig, 10 ref. National Cancer Institute Contract CA44289.

Descriptors: *Aquatic animals, *Benthic fauna, *Benzopyrene, *Food chains, *Marine animals, *Marine environment, *Path of pollutants, *Toxicology, Animal metabolism, Biotransformation, Contamination, Diets, Fate of pollutants, Flounders, Hydrocarbons, Metabolites, Polychaetes, Radioactivity, Trophic level, Urban watersheds, Water pollution effects.

Coastal sediments in urban environments are known to contain high concentrations of organic contaminants such as polycyclic aromatic hydrocarbons (PAH) which can be accumulated and metabolized to some extent by many benthic invertebrates. The potential for trophic transfer of PAH metabolites from infaunal organisms to bottom-feeding fish was determined by giving single oral doses of ground polychaetes (Nereis virens), either treated with pure carbon-14 labeled benzo(a)pyrene (BaP) or containing a mixture of naturally produced radiolabeled BaP and BaP metabolites, to winter flounder (Pseudopleuronectes americanus). Fish were sacrificed 24 hours after feeding and total accumulated radioactivity and metabolite class profiles determined in major areas. Metabolites produced by worms were absorbed by flounder, although as a percentage of dose given they were less available than parent BaP. Comparison of metabolite profiles accumulated through the diet can be further modified by the prey organism and can lead to the formation of bound residues. These results demonstrate the availability of PAH metabolites in the diet. Furthermore, metabolites absorbed appear to be susceptible to metabolic alteration by consumer organisms. (Author's abstract)
W91-06361

COMPARISON OF ABSORPTION RATES OF HALOGENATED PHENOLS ACROSS FISH GILLS IN FRESH AND MARINE WATER.
Uppsala Univ. (Sweden). Dept. of Zoophysiology.
P. Part.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 275-278, 1989. 2 fig, 7 ref.

Descriptors: *Fish physiology, *Gills, *Halogenated compounds, *Path of pollutants, *Phenols, *Toxicology, *Trout, Absorption, Adaptation, Freshwater, Hydrogen ion concentration, Salinity, Seawater, Water quality.

The absorption rates of five halogenated phenols across the gill epithelium of freshwater-adapted and seawater-adapted rainbow trout was measured. At pH 6, when the compounds are present mainly in the non-ionized form, the absorption rates in fresh water were higher than in seawater. At pH 9 no differences in absorption rates between the two water qualities were observed for those phenols present in ionized form. Adaptation to seawater reduces, to some extent, the permeability of the gills for the non-ionized forms of the compounds. These results show that the gill epithelium of freshwater-adapted rainbow trout is more permeable for the non-ionized form of halogenated phenols than the epithelium of seawater-adapted trout. The pH of the water appears to be the most important water quality parameter in modifying the absorption rates of these compounds. (Brunone-PTT)
W91-06363

DNA ADDUCTS AS BIOMARKERS IN GENOTOXIC RISK ASSESSMENT IN THE AQUATIC ENVIRONMENT.
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
B. Kurelec, A. Garg, S. Krca, and R. C. Gupta.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 317-321, 1989. 1 fig, 14 ref. US EPA Cooperative Agreement CR 813840; US PHS Grant CA 30606.

Descriptors: *Animal metabolism, *Aquatic environment, *Bioassay, *DNA, *Genotoxicity, *Path of pollutants, *Risk assessment, *Toxicology, *Water pollution effects, Bioindicators, Carcinogenicity, Dosimetry, Fish physiology, Phosphorus radioisotopes, Sea mussels.

Tho phosphorus-32 postlabeling assay has recently been employed to demonstrate the presence of pollution-related DNA adducts in fish and mussels from polluted rivers and seas. The presence of natural (pre-existing) DNA adducts in indicator organisms may complicate the use of pollution-related DNA-adduct measurements as a biomarker in the assessment of both the biologically relevant exposure to carcinogens and the pathobiological consequences of that exposure. Detection and identification of exposure-related DNA adducts in marine and freshwater organisms (sponges, mussels, and fish) is possible, despite the presence, sometimes, of great numbers and significant levels of natural DNA adducts. This analysis method can serve both as an internal dosimetry badge and fingerprint of the exposure to genotoxic substances. (Author's abstract)
W91-06367

ROLE OF THE RED GLAND IN MERCENARIA MERCENARIA IN DETOXIFICATION.
Environmental Protection Agency, Narragansett, RI.
G. Zaroogian, P. Yevich, and S. Pavignano.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 447-450, 1989. 1 tab, 10 ref.

Descriptors: *Animal metabolism, *Bivalves, *Clams, *Cytology, *Detoxification, *Fate of pollutants, *Toxicology, Biodegradation, Brown cells, Enzymes, Glutathione reductases, Lysozymes, Percoll gradient, Phosphatases, Red gland.

Brown cells of the red gland in Mercenaria mercenaria are involved in the excretory process. Their involvement in the removal of foreign substances was investigated in tissues of Mercenaria. Toluidine blue (soluble dye) accumulated in brown cells after dye injection into the foot muscle and after addition to brown cell isolates. In comparison, carmine red (particulate dye) did not accumulate under the same conditions. FITC-labeled bovine albumin accumulated in brown cells when introduced in vivo and to cell isolates. Kinetic studies indicated uptake of FITC-albumin occurred within 2 hours when added to cell isolates and within 24 hours after injection into the foot muscle. Brown cell isolates were separated into three fractions on a discontinuous Percoll gradient. Fraction 1 contained primarily what appeared to be precursor brown cells. The majority of cells in Fraction 2 were brown cells. Fraction 3 was entirely brown globular material. Assays indicated the presence of acid phosphatase, glutathione reductase and lysozyme in lysates from each fraction. Thus, brown cells of the red gland appear to contain enzymes involved in detoxification and degradative processes. (Author's abstract)
W91-06384

EFFECT OF SELENIUM ON THE UPTAKE OF CADMIUM BY THE MARINE MACROALGA HYMENOMONAS (CRICOSPHAERA) ELONGATA.
Institut National de la Sante et de la Recherche Medicale, Paris (France).
For primary bibliographic entry see Field 5C.
W91-06386

ORGANOTIN SPECIATION IN MUNICIPAL WASTEWATER AND SEWAGE SLUDGE: ECOTOXICOLOGICAL CONSEQUENCES.
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
K. Fent.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 477-483, 1989. 2 fig, 1 tab, 16 ref.

Descriptors: *Chemical speciation, *Organotin compounds, *Path of pollutants, *Sludge, *Toxicology, Aquatic environment, Chemical analysis, Ecotoxicology, Extraction, Flame photometry, Gas chromatography, Pollutant identification, Quantitative analysis, Sediment chemistry, Wastewater pollution.

Accurate and precise quantitative methods are needed for speciation of organotins in complex matrices like wastewater, sludge, sediments and biological materials. Organotins were determined by extraction, ethylation by a Grignard reaction, and analysis by gas chromatography with flame photometric detection. Limit of detection was 1 to 10 ng/L for each organotin species. For higher accuracy, four separate internal standards with different degrees of alkylation were used. In raw wastewater mean concentrations on 3 days were (as ions): 199 ng/L of monobutyltin (MBT), 164 ng/L of dibutyltin (DBT), and 173 ng/L of TBT (total 536 ng/L). Monophenyltin, diphenyltin, triphenyltin, tricyclohexyltin and dioctyltin were not detected. About 90% of each butyltin species were associated with particles, and thus removed to a large extent by sedimentation in the first step of a treatment plant. In sewage sludge, organotins were accumulated to relatively high concentrations. In one sample of digested sludge the following concentrations were determined: MBT 0.6 mg/kg, DBT 1.2 mg/kg, and TBT 1.1 mg/kg (dry wt). Untreated wastewater could give rise to pollution of aquatic systems. As sludge is used as fertilizer in agriculture, organotins are transferred to soils. In addition, since sludge is dumped at sea in large amounts, a mainly unrecognized source of TBT in the marine environment is identified. (Author's abstract)
W91-06388

EFFECTS OF STARVATION ON CADMIUM UPTAKE BY A MARINE PSEUDOMONAD.
Institut National de la Sante et de la Recherche Medicale, Paris (France).
G. N. Flatau, R. L. Clement, F. Mahdyoun, and M. J. Gauthier.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 485-488, 1989. 2 fig, 19 ref.

Descriptors: *Bacterial physiology, *Bioaccumulation, *Cadmium, *Marine environment, *Path of pollutants, *Seawater, *Starvation, *Toxicology, Cytology, Heavy metals, Marine pollution, Nutrient concentrations, Nutrition, Phosphorous, Toxicity.

Natural environments, particularly unpolluted seawater, represent a very poor nutritive medium containing only a few microgram-atoms phosphorus/L. Cells of a marine pseudomonad were starved for 216 hours in a saline non-nutritive medium. During this period, respiratory activity and cellular ATP decreased. When such cells were exposed to cadmium, their cadmium content was lower than that of freshly harvested cells. The addition of glucose to starved cells just before their exposure to cadmium enhanced their cadmium uptake and their respiratory activity. These results suggest that starvation induces large modifications in the structure and physiology of these cells, and can also inhibit the accumulation of toxic metals which are taken up by energy dependent mechanisms. Microbial responses to pollutants, therefore, may depend highly upon the nutritional state of microorganisms. (Brunone-PTT)
W91-06389

UPTAKE OF CU, CD, ZN AND PB IN POSIDONIA OCEANICA (LINNEAUS) FROM ANTIKYRA GULF, GREECE: PRELIMINARY NOTE.
Thessaloniki Univ., Salonika (Greece). Inst. of Botany.
P. Malea, and S. Haritonidis.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 495-498, 1989. 3 fig, 16 ref.

Descriptors: *Antikyra Gulf, *Bioaccumulation, *Cadmium, *Copper, *Lead, *Path of pollutants, *Toxicology, *Zinc, Aquatic plants, Greece, Heavy metals, Plant growth, Sea grasses, Seasonal variation, Statistical analysis.

The uptake of copper, zinc, cadmium and lead was studied in the marine phanerogam Posidonia oceanica, sampled from seven stations in the Gulf of Antikyra, Biotia, Greece. The mean values of the concentrations of the four heavy metals were compared between the stations. No significant differences were noted between stations in the accumulation of metals. However, concentrations of copper, zinc and lead in Posidonia reached a maximum in the winter and in early spring and then decreased in the spring months to reach a minimum during the summer. This seasonal variation was only statistically significant for copper, and was associated with the annual life cycle of the plant. Cadmium also showed significant seasonal variation but concentrations reached a maximum during the summer and declined to a minimum during the spring. The decrease in the accumulations of copper, lead, and zinc during the stage of higher growth is probably explained by an irreversible binding of heavy metals to the plant tissue and a dilution of metals due to growth. (Author's abstract)
W91-06391

PLANAR CHLORINATED HYDROCARBONS (PCHS) IN COLONIAL FISH-EATING WATERBIRD EGGS FROM THE GREAT LAKES.
Michigan State Univ., East Lansing. Dept. of Pediatrics/Human Development.
For primary bibliographic entry see Field 5C.
W91-06393

TREATED MUNICIPAL WASTEWATERS: EFFECTS ON DEVELOPMENT AND GROWTH OF FISHES.
New Jersey Medical School, Newark. Dept. of Anatomy.
For primary bibliographic entry see Field 5C.
W91-06396

MOBILITY IN SANDY SOILS OF FOUR PESTICIDES WITH DIFFERENT WATER SOLUBILITY.
Sveriges Lantbruksuniversitet, Uppsala. Dept. of

Soil Sciences.
R. Jernlas.
Acta Agriculturae Scandinavica AASCAU, Vol. 40, No. 4, p 325-340, 1990. 7 fig, 6 tab, 22 ref.

Descriptors: *Path of pollutants, *Pesticides, *Pollutants, *Soil contamination, *Solute transport, Adsorption, Atrazine, Chemical degradation, Groundwater pollution, Isotherms, Model studies, Sand, Solubility.

Despite the advantages of pesticides, increasing interest has been paid to their transport to groundwater by leaching. The mobility of four pesticides--2,3,6-TBA (2,3,6-trichlorobenzoic acid), dichlorprop ((+/-)-2-(2,4-dichloro-phenoxy)-propionic acid), atrazin (2-chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine) and dichlobenil (2,6-dichlorobenzonitril)--was measured in soil column and batch experiments. The soils used were classified as sands and loamy sands with organic matter contents ranging from 0 to 3.65%. Systematic deviations were generally found in column experiments between experimental and fitted effluent curves. Thus the analytical model equation used did not describe all aspects of the transport process well, possibly because of violation of the assumption of a linear adsorption isotherm. The estimated retardation factors from the column experiments were in the range 0.92-1.27, 1.01-1.41, 1.34-4.77, and 4.22-55.6 for 2,3,6-TBA, dichlorprop, atrazin, and dichlobenil, respectively. The column experiments were found to give reproducible estimates of the transport parameters, but the estimated degradation rates showed substantial variation. The linear form of the Freundlich isotherm obtained from the column experiments was compared to the more or less nonlinear form obtained in batch experiments by calculating theoretical effluent curves for the two types of adsorption isotherms. The agreement was poor for dichlorprop in topsoils, but reasonable to good for all other soils and pesticides. In the case of dichlobenil in topsoil, with a Freundlich isotherm far from linear, the chosen concentration strongly influenced the shape and position of the calculated effluent curve. (Author's abstract)
W91-06397

RATES OF SOIL CHEMICAL CHANGES WITH ELEVEN ANNUAL APPLICATIONS OF CATTLE FEEDLOT MANURE.
Agriculture Canada, Lethbridge (Alberta). Research Station.
C. Chang, T. G. Sommerfeldt, and T. Entz.
Canadian Journal of Soil Science CJSSAR, Vol. 70, No. 4, p 673-681, November 1990. 1 fig, 4 tab, 18 ref.

Descriptors: *Agricultural practices, *Alberta, *Farm management, *Irrigation effects, *Manure, *Soil chemistry, Application rates, Calcium, Canada, Chlorides, Land application, Leaching, Magnesium, Nutrients, Regression analysis, Salts, Sodium, Solute transport, Sulfates, Tillage.

The rates of change of several soil chemical properties in response to repeated annual applications of cattle feedlot manure were determined from 1974 to 1984 in a long-term experiment in Alberta, Canada. Manure was applied at 0, 30, 60, and 90 mg/ha and 0, 60, 120, and 180 mg/ha (wet weight) to nonirrigated and irrigated Dark Brown Chernozemic soils, respectively, using three tillage methods of incorporation. Soil acidity (pH), estimate of soluble salts (EC), sodium adsorption ratio (SAR), and accumulation of Na, Ca + Mg, SO4, and Cl in the soil were determined annually. Regression analyses were used to determine the rates of accumulation of these parameters with time. The rates of change with time were mostly linear and varied with the level of manure applied and irrigation regime. The soil became more acidic with time. Soluble Na and Cl increased at rates similar to or less than those applied. Changes in the soluble SO4 were poorly correlated with time. Regression analyses from 1974 to 1977 and 1978 to 1984, under irrigated conditions, indicated that the rates of change were generally less in the latter period. Thus, the losses of applied constituents were higher in the second period than in the first period under irrigation. However, various soluble constituents from the annually-applied manure accumulated in the soil even at the recommended rate. These findings indicate that sustained agricultural production of this land with annual application of manure is in question, and the potential for problems due to leaching of various soluble salts and nutrients to groundwater is increased. (Author's abstract)
W91-06408

SLUDGE METAL BIOAVAILABILITY.
Ohio State Univ., Columbus. Dept. of Agronomy.
T. J. Logan.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 399-405. 1 fig, 22 ref.

Descriptors: *Bioaccumulation, *Bioavailability, *Heavy metals, *Land application, *Land disposal, *Sludge, *Sludge utilization, *Soil contamination, Cadmium, Path of pollutants.

Recent findings suggest that trace metals in sewage sludge are retained tightly by the sludge solids and that this retention greatly reduces the bioavailability, particularly with respect to plant uptake, of sludge metals compared with other metal sources. Long-term field studies indicate little change in sludge metal bioavailability with time after initial sludge application, which suggests that sludge metal forms may be as thermodynamically stable as those in soil. Field and greenhouse studies suggest that the increase in metal uptake by crops is not linear with sludge application rate but rather reaches a plateau, the magnitude of which is a function of sludge properties. The most important sludge property related to sludge metal bioavailability appears to be total metal concentration. However, labile metal, as estimated by resin extraction, may prove to be a more precise indicator of sludge metal bioavailability. Field data on metal uptake by crops from sewage sludge suggest that uptake does not increase linearly with sludge metal application rate, but rather tends to plateau at higher rates. It would be valuable to use the plateau concept in a risk assessment of food-chain contamination by sludge metals by comparing the plateau value for crop uptake with maximum food-chain exposure. In this way, a sludge with a plateau value for crop uptake less than that required to protect the food chain could be applied to cropland regardless of application rate and perhaps with minimal effect on soil properties. Extending this approach further, it would be valuable to identify the sludge characteristics that control the plateau uptake value or to develop a sludge test to predict this value. In a recent study of Cd uptake by Sudax (a sorghum-sudangrass hybrid) Cd uptake was correlated with total Cd content of the sludges and with resin-extractable sludge Cd. Resin-extractable Cd was shown to be a good indicator of labile sludge metals and may be used to screen sludges for impact on crop uptake. (See also W91-06421) (Geiger-PTT)
W91-06448

SLUDGE ORGANICS BIOAVAILABILITY.
New Mexico State Univ., Las Cruces. Dept. of Agronomy and Horticulture.
G. A. O'Connor, G. A. Eiceman, C. A. Bellin, and J. A. Ryan.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 407-416. 2 fig, 4 tab, 31 ref.

Descriptors: *Bioaccumulation, *Bioavailability, *Chlorinated hydrocarbons, *Land disposal, *Organic compounds, *Path of pollutants, *Sludge, *Sludge disposal, Biodegradation, Land application, Pentachlorophenol, Polychlorinated biphenyls.

Greenhouse studies using soil-sludge mixtures spiked with chlorinated hydrocarbons (polychlorinated biphenyls, pentachlorophenols, diethylhexylphthalate, or 2,4-dinitrophenol) or with sludge containing the hydrocarbons applied to soils were carried out to assess the plant uptake of chlorinated hydrocarbons when grown on the contaminated soils. Biological concentration factors (BCF) were calculated for crops (fescue, lettuce, carrots, and chile) grown on the soil or soil-sludge mixtures. Sludges applied at agronomic rates resulted in chemical concentrations in the soil-sludge mixture 50 to 100-fold lower. Plant uptake at these pollutant concentrations (and at much higher concentrations) is minimal. Chemicals were either (1) accumulated at extremely low levels (polychlorinated biphenyls), (2) possibly accumulated, but then rapidly metabolized within the plants to extremely low levels (DEHP), or (3) likely degraded so rapidly in the soil that only minor contamination (BCF < or = 0.01) of the plant occurred (pentachlorophenol and 2,4-dinitrophenol). (See also W91-06421) (Geiger-PTT)
W91-06449

SEWAGE SLUDGE APPLICATION TO AGRICULTURAL LAND.
Battelle Memorial Inst., Columbus, OH.
For primary bibliographic entry see Field 5E.
W91-06451

MICROBIAL INCORPORATION OF SULFATE INTO ORGANIC MATTER IN FOREST SOILS.
Southeastern Forest Experiment Station, Otto, NC.
W. T. Swank, J. W. Fitzgerald, and T. C. Strickland.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 3-10, 3 fig, 3 tab, 17 ref. National Science Foundation Grant BSR-8215259.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Forest soils, *Sulfates, *Sulfur cycle, Fate of pollutants, Forest ecosystems, Litter, Microbiological studies, North Carolina, Soil organic matter.

The metabolism of inorganic sulfate into organic matter by microbial populations can be an important process in the sulfur cycle of forest ecosystems. Potential annual incorporation in forest floor and soil horizons of a mixed deciduous forest in the Southern Appalachian Mountains was studied. Soil samples were collected from a 280-m transect in the Coweeta Watershed in western North Carolina. Varying amounts of sulfate were added and extractions of soil water, salt extracts, and acid plus base (non-salt extractable) fractions were analyzed. The total annual incorporation for litter and soil was estimated to be 30 kg/ha. The magnitude of sulfate incorporation into organic sulfur forms exceeds the bulk precipitation sulfate-sulfur input of 9 to 13 kg/ha/yr. Moreover, incorporation greatly exceeds the 2 kg/ha/yr of net sulfur uptake by vegetation previously estimated for a similar watershed. It may be concluded that the process is partially responsible for the apparent sulfur accumulation indicated by ecosystem budgets and affects sulfate mobility, cation leaching, and hence the interpretation of atmospheric sulfuric acid effects in forest ecosystems. (See also W91-06510) (Fish-PTT)
W91-06511

ACIDITY AND ALKALINITY OF RESERVOIR WATER IN THE SIERRA NEVADA, CALIFORNIA.
California Univ., Berkeley. Dept. of Plant and Soil Biology.
J. G. McColl.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 11-18, 2 fig, 4 tab, 4 ref. University of California project CA-B-PSB-3664-H.

Descriptors: *Acid rain, *Acid rain effects, *Lake acidification, *Rainfall-runoff relationships, *Reservoirs, *Water pollution sources, Air pollution effects, Alkaline water, Nitrogen oxides, Snowmelt, Sulfur dioxide, Water acidity.

From 1954 to 1979 outlet waters from the two main Sierran reservoirs supplying the San Francisco Bay Area of California have significantly increased in acidity, and since 1944 alkalinity of one

of the reservoirs has significantly decreased. This data has been updated to 1985 for one of the two reservoirs previously studied, and the relationship between acidity and alkalinity of water, air pollutants, and water flow have been examined in more detail. It was determined that acidity changed during all months of the year, but alkalinity only changed during July through November. It is likely that the greatest acidity increase in runoff is due to increased acidity of peak snowmelt in May. The cause appears to be atmospheric emissions of sulfur dioxide (SO2) and nitrogen dioxide (NOx) from the metropolitan area deposited in the Sierra Nevada drainage basin. Since the early 1970s emissions varied greatly with fluctuating fuel oil prices and new control regulations, thus complicating relationships between gaseous emissions and reservoir chemistry. However, with a 3 to 4-year lag time, significant correlations exist between gaseous emissions (especially SO2) and water acidity and alkalinity for two separate periods, 1955-72 and 1972-85. (See also W91-06510) (Author's abstract)
W91-06512

DYNAMICS AND MASS BALANCES OF NO3(-) AND SO4(-2) IN MELTWATER AND SURFACE-RUNOFF DURING SPRING MELT IN A BOREAL FOREST.

Quebec Univ., Sainte-Foy.
H. G. Jones, and Y. Bedard.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 19-31, 4 fig, 2 tab, 21 ref.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Forest soils, *Soil contamination, Canada, Nitrates, Pollution load, Quebec, Runoff, Snowmelt, Soil horizons, Soil water, Sulfates, Water pollution effects, Water pollution sources.

In eastern Canada the boreal forest receives much of its precipitation as snow, relatively enriched in NO3(-). The chemical evolution of meltwater from the snowpack, intermittent streamwaters, and subsurface waters of the Lake Laflamme basin, Quebec, Canada, was studied during the spring melt periods of 1984 and 1985. It was found that the upper organic soil horizons are the dominant factor in the control of NO3(-) concentrations in surface waters. In 1984, these horizons acted as a source for NO3(-) (2 meq/sq m) exceeding the NO3(-) load (10.0 meq/sq m) discharged by the snow pack (including precipitation). In 1985, the horizons acted as a sink for this ion by retaining 1.3 meq/sq m of the total load discharged (12.9 meq/sq m). In comparison, SO4(-2) concentrations in the runoff are more dependent on the chemical characteristics of water in the lower soil horizons. The upper horizons, however, exert a buffering effect on the concentration of this ion in the streamwaters. The soil horizons act generally as a source for SO4(-2) exceeding the SO4(-2) load discharged by the pack, supplying approximately 40% (1984: 42%; 1985: 37%) of the total load of SO4(-2) (1984: 43.5 meq/sq m; 1985: 34.1 meq/sq m) exported by the surface runoff in both spring melt periods. (See also W91-06510) (Author's abstract)
W91-06513

INFLUENCE OF ACID PRECIPITATION ON STREAM CHEMISTRY IN A SMALL FORESTED BASIN IN SOUTHWESTERN BRITISH COLUMBIA.

British Columbia Univ., Vancouver. Faculty of Forestry.
M. C. Feller.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 33-47, 2 fig, 7 tab, 19 ref. Department of Supply and Services Canada contract nos. 06SB.KH603-4-1054 and 06SB.01K51-5-1084.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Forest management, *Water chemistry, Aluminum, British Columbia, Buffer capacity, Canada, Hydrogen ion concentration, Soil contamination, Water pollution effects.

As part of a study on the effects of forest management practices on streamwater quality, precipitation, and streamwater chemistry have been assessed since 1970 in a small forested drainage basin located in southwestern British Columbia, Canada. Precipitation in the area is acidic with mean annual pH values of 4.5-4.9 and anion chemistry dominated by SO4, followed by NO3. Streamwater in the area generally contains low quantities of dissolved chemicals and has a relatively low buffer capacity of 20-70 micromol/L. However, the acid precipitation has not significantly impacted streamwater chemistry. Streamwater pH values less than 6.1 have not been recorded and pH decreases of only 0.1 to 0.4 occur during storm events. High streamwater dissolved Al(+3) concentrations do not occur and most of the dissolved Al is organically complexed. The soils present are being acidified causing basic cations to be released from the soil. Generation of hydrogen ions within the watersheds exceeds the external supply. (See also W91-06510) (Author's abstract)
W91-06514

ACID BUFFERING IN LOWLAND FORESTED ECOSYSTEMS: A CASE STUDY IN THE TRENT BASIN, UK.

Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
I. D. L. Foster.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 49-63, 5 fig, 3 tab, 31 ref.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Trent River Basin, *Water pollution effects, Acidic water, Canopy, England, Soil contamination, Throughfall, Water pollution sources, Water quality.

Studies of the impact of acid precipitation on natural waters frequently concentrate on upland hard rock environments which usually illustrate a dramatic response in terms of water quality and ecological deterioration. Less well documented, especially in the UK, are river basins which receive acid inputs but where river waters remain at or above a neutral pH. A monitoring program was undertaken in the English Midlands which is an area with recorded mean monthly rainfall pH below 5.0 for 7 months of the year, dropping to pH 4.5 in February. Canopy drip in a broad-leaved oak woodland has an average annual pH of 4.1. Soil water samples extracted from the unsaturated zone closely mirror throughfall pH and show little buffering of acid inputs. Low pH values are not recorded in river and lake water samples collected in the same area, where pH lies between 7 and 7.5. (See also W91-06510) (Author's abstract)
W91-06515

STREAM ACIDIFICATION RESULTING FROM AFFORESTATION IN THE UK: EVALUATION OF CAUSES AND POSSIBLE AMELIORATIVE MEASURES.

Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
M. Hornung, B. Reynolds, P. A. Stevens, and C. Neal.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 65-74, 4 tab, 21 ref.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Forest management, *Forest soils, *Reforestation, Acidic soils, Acidic water, Air pollution effects, Aluminum, Canopy, Drainage ditches, Drainage water, Soil water, United Kingdom, Water pollution sources.

Recent studies have shown an increase in acidity and aluminum concentrations in streams draining plantation forests, compared with streams draining adjacent moorland or grassland, in some areas of the British uplands. Afforestation leads to a number of changes in the upland environment which, in turn, impact the hydrology and hydrochemistry of drainage waters. Some of these changes are due to forest management practices while others result from crop-atmosphere and crop-soil interactions. These changes are most pronounced where soils overlie base-poor bedrock, and have a surface pH of 3.5-4.5. Forest drains, linked to upland plow furrows, are designed to remove any excess soil water and limit soil water interactions and any related buffering. The development of the forest canopy in the uplands increases evaporation, reduces the amount of incoming precipitation, and acts as an efficient filter of the atmosphere. Development of the forest floor allows accumulation of more acid matter than the underlying soil horizons and is an important zone of (acidic) water movement. The drying cracks and root channels within forest soils act as pathways for the rapid movement of water through soils. Deepening of drainage ditches could allow contact between drainage waters and more base-rich mineral materials, leading to increased buffering. The system of plow furrows and drainage ditches act together to feed acid, surface waters directly into natural water courses. These waters could be diverted by dams, sumps, bog development, or a combination. The reduction of emissions of SO2 and NOx would have a significant impact on atmospheric inputs, and should be taken into account when developing on-site ameliorative measures. (See also W91-06510) (Fish-PTT)
W91-06516

APPLICATION OF TIME-SERIES MODELLING TO SHORT-TERM STREAMWATER ACIDIFICATION IN UPLAND SCOTLAND.

Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
S. J. Langan, and P. G. Whitehead.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 75-87, 7 fig, 3 tab, 10 ref.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Model studies, *Time series analysis, Catchment areas, Land use, Mathematical analysis, Mathematical models, Scotland, Stream discharge, Water quality management, Water resources management.

In the study of water resources the ability to simulate water quality is desirable to improve understanding and forecasting of the processes and dynamics within drainage basin systems. In a system analysis approach the processes are replaced by mathematical functions, useful where the system is exceedingly complex or where there is inadequate knowledge of the processed governing the input-output relationship. The hourly discharge and stream pH were modeled on three basins in southwest Scotland, differentiated by land-use. In this investigation, both the series input and output of the system were known; what remained was to identify and estimate the transfer function, where the system (drainage basin) received a stimulus (discharge) and responded to it according to the internal structure (hydrochemical processes) of the system, determining the system output (acidity, expressed as hydrogen ion concentration). The best-fit time-series model for each of the basins had the same simple structure (first-order autoregressive moving average type) identified from a calibration run on one month of hourly observations. Results showed that a moorland basin and a forested (eight-year-old Sitka Spruce) basin have broadly similar water quality. The third, part-forested, basin illustrated how autoregressive management techniques (e.g. liming) may ameliorate surface water acidification, both in terms of magnitude and duration. While the model is not particularly powerful in terms of predictability, it has been useful in identifying the differences between the three basins in terms of water quality. The modifying influence of land management techniques on one of the basins is particularly pertinent to the short-term solution of streamwater acidification. (See also W91-06510) (Author's abstract)
W91-06517

CONTRIBUTIONS OF ACID DEPOSITION TO STREAMWATER CHEMISTRY IN THREE PRECAMBRIAN SHIELD BASINS.

Great Lakes Forestry Research Centre, Sault Sainte Marie (Ontario).
J. A. Nicolson.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 89-98, 1 fig, 4 tab, 13 ref.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *Hydrologic budget, *Path of pollutants, *Water chemistry, Canada, Cations, Forest watersheds, Geochemistry, Nitrates, Ontario, Sulfates, Water quality.

Chemical budgets of small terrestrial basins may be examined by measuring the quantity and quality of precipitation and streamflow for each system. Water and chemical budgets were examined for small, undisturbed mature forest basins in three areas in northern Ontario, Canada. Precipitation averages, based on four years, varied less than 4% of normal, but variation of streamflow averages, though consistent at all sites, was 25-30% above normal. Sulfate input dominated precipitation at the eastern site and was two times the SO4 input at the central site and three times at the western site. Nitrate was highest in the east, being about four times greater than at the other two sites. The H input was five to six times greater at the eastern site. Output was dominated by SO4, Ca, and HCO3 in the west; HCO3, Ca, and SO4 at the central site; and SO4, HCO3, and Ca at the eastern site. Only two cations, H and NH4, were retained within the basin at all sites; both were highest in the east. All sites lost major cations; the largest loss was at the central site, which had the richest soil. Carbonate in glacial till was important in neutralizing acidity at the central and eastern sites. Comparison of these results with those of other basin budget studies on the Precambrian Shield showed that elemental input and output were in general agreement; however, ion losses are variable and can be related to minor differences in geologic makeup in local areas. It appears that stream chemistry on the Canadian Shield reflects the interactions of forest type, bedrock, till, and soil composition within a basin rather than the chemical composition of precipitation. (See also W91-06510) (Fish-PTT)
W91-06518

SOURCES OF ACIDITY DURING SNOWMELT AT A FORESTED SITE IN THE WEST-CENTRAL ADIRONDACK MOUNTAINS, NEW YORK.
Geological Survey, Doraville, GA.
N. E. Peters, and C. T. Driscoll.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 99-108, 5 fig, 18 ref.

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *New York, *Water chemistry, *Water pollution sources, Acidic water, Forest soils, Groundwater chemistry, Leaching, Nitrification, Path of pollutants, Snowmelt, Snowpack, Soil water, Solute transport.

Processes controlling the acidification (pH < 5.0) of streams and lakes during snowmelt are not well understood. The chemical quality of precipitation, snowpack, meltwater, and forest floor leachate was evaluated to determine the impact of these sources on stream acidification in the west-central Adirondack Mountains, New York. It was found that solutes in the snowpack were preferentially released at the beginning of snowmelt causing elevated concentrations of acidity and strong acid anions, NO3(-) and SO4(-2), in the meltwater; these decreased rapidly within a few days as the melt continued. Stream SO4(-2) concentration was relatively constant (140 microeq/L) through winter. Groundwater discharge appears to be a primary control of stream composition, because the stream SO4(-2) concentration was comparable to, or slightly lower than that of groundwater or soil water, but was more than double that of meltwater or forest floor leachate. Nitrification in the forest floor produced 2-3 times higher acidity (H+) and NO3(-) concentrations in leachates than in meltwater. Stream H(+) and NO3(-) concentrations increased during late winter, and the increases are attributed to the flushing of these solutes from the forest floor through the soil to the stream. (See also W91-06510) (Author's abstract)
W91-06519

FOREST INFLUENCE ON THE SURFACE WATER CHEMISTRY OF GRANITIC BASINS RECEIVING ACID PRECIPITATION IN THE VOSGES MASSIF, FRANCE.
Strasbourg-1 Univ. (France). Inst. de Geologie.
A. Probst, B. Fritz, B. Ambroise, and D. Viville.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 109-120, 3 fig, 3 tab, 16 ref. Programme DEFORPA (CEE-DG XII, Ministere de l'Environnement).

Descriptors: *Acid rain, *Acid rain effects, *Forest hydrology, *France, *Water chemistry, Air pollution, Anions, Fate of pollutants, Forest watersheds, Neutralization, Path of pollutants, Surface water, Throughfall.

The acidity of rain water has been clearly established as part of a general atmospheric problem in northwestern Europe. The influence of acid rain on the chemistry of surface waters was studied in the Strengbach and Ringelbach basins on the eastern and Alsacian side of the Vosges mountains in eastern France. The two small basins present similar altitudes and climates, although one is forested, and the forest decline has been clearly established. In both basins, rain water is polluted by acids: H(+), SO4(-2), NO3(-). This acid input is neutralized in soils but the efficiency of that neutralization varies from one basin to another: (a) in the nonforested basin, the alkalinity of surface water dominates the anionic charge, (b) in the forested basin, the strong acid anions still dominate the anionic charge of a just-neutralized solution. The chemistry of surface water in the forested basin cannot be explained only by the incident rainfall and its partial evaporation. There appears to be a major input of pollutant through dry deposits in throughfall. (See also W91-06510) (Author's abstract)
W91-06520

DETERMINATION OF HYDROLOGICAL FLOW PATHS AND ASSOCIATED HYDROCHEMISTRY IN FORESTED CATCHMENTS IN CENTRAL SCOTLAND.
Imperial Coll. of Science and Technology, London (England).
H. S. Wheater, S. J. Langan, J. D. Miller, and R. C. Ferrier.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 433-449, 7 fig, 6 tab, 23 ref.

Descriptors: *Acid rain, *Flow pattern, *Forest hydrology, *Forest watersheds, *Land use, *Scotland, *Soil-water-plant relationships, *Water chemistry, *Watershed management, Canopy, Forest soils, Groundwater movement, Slopes, Soil horizons, Soil water, Stemflow, Stream chemistry, Throughfall.

In studies of the impact of acid precipitation on surface water quality, increasing attention has been focused on the role of vegetation and land use management practice in enhancing surface water acidification. For effective management, quantification is required of the role of canopy processes, soil chemistry, nutrient cycling, and subsurface flow characteristics, and the impact of cultivation practice such as fertilizer application and drainage treatment. Replicated experimental plots were established, as part of an acid deposition research project in central Scotland, to determine hydrological flow paths and the associated hydrochemistry on two adjacent forested catchments in areas of similar geology but with differing tree species, soil types, and capacity to sustain a fish population. Cut soil faces were used to sample soil water throughflow from the major soil horizons. Baseline monitoring of accumulated precipitation, tree throughfall and stemflow, and soil water throughflow was carried out at fortnightly intervals on these plots, some of which were instrumented to include continuous recording of precipitation and soil water throughflow, event sampling, and continuous monitoring of soil moisture dynamics using a distributed tensiometer network. Selected results from one catchment obtained during 1986 indicates clearly the importance of canopy effects and the similarity in response of the dominant B/C horizon throughflow and stream chemistry. A complex spatial pattern of surface wetting was observed, leading to the generation of a downslope wetting front which may have different transmission rates in the different soil horizons. (See also W91-06510) (Fish-PTT)
W91-06551

FACTORS INFLUENCING MOBILITY OF TOXIC METALS IN LANDFILLS OPERATED WITH LEACHATE RECYCLE.
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5E.
W91-06671

SORPTIVE BEHAVIOR OF SELECTED ORGANIC POLLUTANTS CODISPOSED IN A MUNICIPAL LANDFILL.
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5E.
W91-06672

AQUATIC TEST SYSTEMS FOR STUDYING THE FATE OF XENOBIOTIC COMPOUNDS.
Environmental Research Lab., Gulf Breeze, FL.
C. R. Cripe, and P. H. Pritchard.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 29-47, 8 fig, 3 tab, 48 ref.

Descriptors: *Aquatic environment, *Fate of pollutants, *Laboratory methods, *Path of pollutants, *Toxicology, *Water pollution effects, Biodegradation, Ecological effects, Ecosystems, Model studies, Risk assessment.

A variety of test systems, including microcosms, have been developed to provide information on the environmental fate of test compounds in aquatic ecosystems. As the overall strategy for development of tests has been less than logical and only vaguely chronological, it is believed that some degree of characterization and guidance in the application of these test systems is appropriate. This approach is based on four criteria: environmental inocula, sediment, generation of degradation rates, and intact water/sediment cores. Test systems either: (1) provide basic biodegradability/rate information (Screening Tests); or (2) answer research questions about biodegradation rates and their controlling factors in the environment. Shake flask tests are recommended for degradation rate information and to assess the significance of environmental factors on degradation. Intact core microcosm systems are useful to study a limited number of processes that cannot be examined in shake-flasks and, with a mathematical model, to verify biodegradation rates obtained from simpler test systems using conditions more reflective of natural conditions. Toxicity and initial concentration may dominate the hazard assessment process for some compounds under certain circumstances, making persistent testing essentially irrelevant. (See also W91-06691) (Lantz-PTT)
W91-06694

USE OF MICROCOSMS VERSUS CONVENTIONAL BIODEGRADATION TESTING FOR ESTIMATING CHEMICAL PERSISTENCE.
Monsanto Co., St. Louis, MO.
For primary bibliographic entry see Field 5C.
W91-06695

BIODEGRADATION AND REDUCTION IN AQUATIC TOXICITY OF THE PERSISTENT RIOT CONTROL MATERIAL 1,4-DIBENZ-OX-AZEPINE.
Chemical Research, Development and Engineer-

ing Center, Aberdeen Proving Ground, MD. Environmental Toxicology Branch.
M. V. Haley, E. L. Vickers, T. C. Cheng, J. DeFrank, and T. A. Justus.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 60-76, 7 fig, 4 tab, 33 ref.

Descriptors: *Aquatic environment, *Biodegradation, *Cleanup, *Dibenzoxazepine, *Fate of pollutants, *Path of pollutants, *Toxicity, *Toxicology, Bioassay, Biological studies, Daphnia, Microenvironment, Organic compounds.

1,4-Dibenz oxazepine (CR), a strong sensory irritant, has previously been reported as recalcitrant to degradation. Alcaligenes denitrificans denitrificans, CR-1, ATCC No. 53957, isolated from microcosms spiked with CR, shows potential as a tool for the degradation of CR waste. A. denitrificans were found to have an extremely high tolerance to CR (200 mg/L). The isolates grew well on the synthetic media spiked with 200 mg/L CR, but showed minimal growth on the microcosm media without CR. No detrimental effects of CR-1 on Daphnia magna were observed. After 10 days the organisms were able to reduce the CR concentration from 200 to 25 mg/L. After 22 days, the concentration of CR was below detectable limits. Ten days after A. denitrificans was inoculated into a stock solution of CR the toxicity to D. magna was reduced more than 50% but not eliminated. Treatment of the CR solution with A. denitrificans resulted in the elimination of toxicity to Selenastrum capricornutum. In trying to elucidate the degradation pathway, it was discovered that CR-1 also degrades o-nitrophenol,3-methylcatechol, and catechol. (See also W91-06691) (Author's abstract)
W91-06696

REVIEW OF CHEMICAL FATE TESTING CONDUCTED UNDER SECTION 4 OF THE TOXIC SUBSTANCES CONTROL ACT: CHEMICALS, TESTS, AND METHODS.
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
J. D. Walker.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 77-90, 3 fig, 8 tab, 13 ref.

Descriptors: *Chemical analysis, *Fate of pollutants, *Laboratory methods, *Monitoring, *Path of pollutants, *Toxicology, Adsorption, Biodegradation, Hazardous wastes, Organic compounds, Photolysis, Toxic Substances Control Act.

Since the implementation of Section 4 (testing chemical substances and mixtures) of the Toxic Substances Control Act (TSCA), the US EPA has received numerous environmental effects, chemical fate or health effects testing recommendations for several hundred chemicals. Information is provided on the types and numbers of Federal Register (FR) notices that EPA has published in response to these testing recommendations. In addition, detailed discussions of the chemicals and tests for which chemical fate testing has been conducted under TSCA Section 4 and the methods used to conduct those tests. As of 31 December 1988, 182 TSCA Section 4 FR notices (including 65 TSCA Section 4 FR notices mentioning chemical fate testing, and 15 TSCA Section 4 FR notices requesting chemical fate testing) had been published by EPA in response to numerous testing recommendations. For the 51 chemicals in the 15 TSCA Section 4 FR notices requesting chemical fate testing, test data for 105 if the requested 120 chemical fate tests had been received by 31 December 1988. Test methods were used for 18 aerobic aquatic, 13 aerobic activated sludge, and 2 anaerobic biodegradation tests, 10 octanol-water partition coefficient tests, 1 aquatic photolysis test, 2 sediment adsorption tests, 9 vapor pressure tests, 1 volatilization rate test, and 23 water solubility tests provided reliable test data. One method used to provide aquatic photolysis test data for phenylenediamines was not conducted in the presence and absence of humic acids, making it difficult to evaluate direct versus indirect photolysis. Other methods should be modified to improve their universal applicability. (See also W91-06691) (Author's abstract)
W91-06697

USE OF SEDIMENT HEAVY METAL BIOAVAILABILITY AS A METHOD OF ENVIRONMENTAL HAZARD ASSESSMENT.
Fluor Daniel, Greenville, SC.
For primary bibliographic entry see Field 5A.
W91-06699

EFFECTS OF SEDIMENT AND THE ROUTE OF EXPOSURE ON THE TOXICITY AND ACCUMULATION OF NEUTRAL LIPOPHILIC AND MODERATELY WATER-SOLUBLE METABOLIZABLE COMPOUNDS IN THE MIDGE, CHIRONOMUS RIPARIUS.
Ohio State Univ., Columbus. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W91-06701

NITROGEN MANAGEMENT AND GROUND WATER PROTECTION.
For primary bibliographic entry see Field 3F.
W91-06731

GROUND WATER QUALITY CONCERNS ABOUT NITROGEN.
Agricultural Research Service, Fort Collins, CO. Soil-Plant-Nutrient Research Unit.
R. F. Follet, and D. J. Walker.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 1-22, 5 fig, 4 tab, 45 ref.

Descriptors: *Groundwater quality, *Nitrates, *Nitrogen, *Nonpoint pollution sources, *Path of pollutants, *Public health, *Water pollution sources, Agricultural practices, Drinking water, Economic aspects, Fertilizers, Groundwater pollution, Leaching, Nitrogen cycle, Regulations, Toxicity.

Concern by the public and others exist about the health, economic, and resource conservation aspects of nitrate leaching into groundwater supplies. An examination of these topics as they relate to nitrogen (N) management and groundwater protection is made. During the past 10 years, annual N fertilizer consumption has increased about 25% in developed countries and about 160% in the developing countries of the world. The public is concerned about toxicity and health effects of nitrate that may be entering groundwater supplies used for drinking water. Of special concern are methemoglobinemia and cancer. Both are discussed as they relate to the possible effects of nitrate ingestion and public health. The economic importance of N for crop production is well known. However, practices to minimize N losses are important to the protection of groundwater. Benefits of decreasing nitrate pollution in groundwater are diffuse, enjoyed by all users of the aquifer, while costs of improving groundwater quality appear to be concentrated among the farmers who must alter their farming practices to reduce nitrate leaching. Therefore, some form of government intervention is needed to align the interests of the individual farmer with the broader social interest. Several public policy options are discussed. Finally, the relationship of N fertilizer use, and modern technology in general, to resource conservation is addressed. Generally, increased crop yields allow more erosive or poorer land to be removed from production, thus decreasing soil erosion and production costs. The relationship of various management, land use, and soil factors to groundwater nitrate concentrations are also discussed. (See also W91-06731) (Author's abstract)
W91-06732

SOURCES OF NITRATE TO GROUND WATER.
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Keeney.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 23-34, 1 fig, 39 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Nonpoint pollution sources, *Water pollution sources, Agriculture, Cropping, Farm wastes, Fertilizers, Nitrogen, Nitrogen compounds, Nutrients.

Efforts to ameliorate nitrate loadings to groundwater must deal with numerous land uses, and a host of potential inputs and sinks in the landscape. However, the literature leaves no doubt that in farmed areas, agricultural activities comprise the bulk of the nonpoint sources of nitrate. Sources can be generalized as high density animal operations where feed is transported into a watershed and manure must be spread at rates in excess of crop nutrient requirements, and row-crop agriculture, particularly cropping based on the use of fertilizer N to supplement crop N needs. In all cases, management practices are available to lessen nitrate inputs, but effective use of these will require changes in the farmer's objectives, consideration of all N sources, and an increased environmental awareness. (See also W91-06717) (Lantz-PTT)
W91-06733

NITRATE IN GROUND WATER IN THE UNITED STATES.
Iowa Dept. of Natural Resources, Iowa City.
G. R. Hallberg.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 35-74, 11 fig, 4 tab, 124 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Nonpoint pollution sources, *Path of pollutants, *United States, *Water pollution sources, Agricultural practices, Cropping, Fertilizers, Groundwater quality, Irrigation, Leaching, Vegetable crops.

Many activities of modern society, including agricultural land use, contribute nitrate contamination to groundwater. Natural background areas commonly show < 2 mg/L NO3-N in shallow groundwater; agricultural areas often exhibit > 10 mg/L, at least seasonally. An expanded use of nitrogen fertilizers has profitably increased agricultural production, but it has also had an adverse impact on water quality in many areas. In responsive groundwater settings, nitrate concentrations have increased concurrent with the increased use of N-fertilizers. Wells and groundwater exhibiting nitrate contamination have been noted in every state in the United States. The major areas exhibiting problems with nitrate contamination of groundwater are: (1) areas of widespread grain production (particularly corn), marked by intensive row-cropping and heavy fertilization; (2) areas with locally intensive animal feeding and handling operations; and (3) areas of irrigation and fertilization of vegetable and specialty crops, particularly shallow-rooted vegetable crops on sandy soils. Groundwater contributes to the nitrate contamination of surface waters through base-flow to streams and lakes. Nitrate loads have increased in many streams, particularly from the midwestern grain-belt eastward, since 1974, in spite of reductions in point source loads. These increases were highly correlated with many measures of agricultural activity. Nitrate concentrations in groundwater typically show significant variability in many dimensions (with depth, spatial orientation, and time) and these variations are often interrelated. Recognition of this variability is important to understand the extent of the problem and to design programs to mitigate it. At present, nitrate contamination is only evident in shallow portions of the groundwater flow system. This is, in part, a function of time; relative to the dimensions of the groundwater system. In many areas, particularly in deeper portions of the groundwater system, the impact of recent nitrate leaching may not be noted for several decades. (See also W91-06717) (Author's abstract)
W91-06734

GROUND WATER NITRATES IN OTHER DEVELOPED COUNTRIES (EUROPE)--RELATIONSHIPS TO LAND USE PATTERNS.
BASF Aktiengesellschaft, Limburgerhof (Germany, F.R.). Agricultural Research Station.
S. Juergens-Gschwind.
IN: Nitrogen Management and Ground Water

Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 75-138, 24 fig, 20 tab, 252 ref.

Descriptors: *Europe, *Groundwater pollution, *Land use, *Nitrates, *Nonpoint pollution sources, *Path of pollutants, *Water pollution sources, Agricultural practices, Cropping, Fertilizers, Leaching, Nitrogen, Nitrogen cycle.

In temperate zones such as those found in Central Europe, the leaching of nitrate is a basic phenomenon. Nitrate is the end product of the natural mineralization of the soil's vast organic N-pool. Natural or anthropogenic factors affect this process, especially land use patterns. Presence and type of crop determine the duration and density of soil cover and thus have a dominant influence on the N-cycle. the leaching of highly water soluble nitrate increases from woodland to grassland to arable land to horticultural land. Bare land, without competitive N-uptake by plant roots, creates the highest losses by percolation, and releases one to two times more NO3 than cropland, and up to nine times more than grassland (meadows). Construction areas and railway tracks react in the same way. Sudden interference in the soil/plant system, e.g. by clear-felling forests or plowing grassland, leads to a pulse of microbial activities and thus to the production of nitrates at high risk of being leached because of lacking plant cover. Nitrate percolates into deeper soil layers at a rate of about 0.3-3 m/yr. Beside crop stand, migration depends on soil type, rainfall and irrigation, temperature, groundwater level and drainage, soil cultivation, rate, timing, form of N containing fertilizers (organic and mineral), and plant protection measures. The literature concerning these effects is thoroughly reviewed. Economic and ecological reasons require nitrate losses to the groundwater to be kept at a low level. A vigorously growing, long-lasting plant cover combined with good fertilizing practice is the best insurance to achieve this and helps keep nitrate losses to a minimum. In horticultural crop patterns, fallow periods and soil cultivation should be reduced and the N-supply from plant residues considered in fertilizer planning. (See also W91-06717) (Author's abstract)
W91-06735

NITRATE TRANSPORT AND LEACHING MECHANISMS.
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, and D. R. Nielsen.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 139-157, 4 fig, 1 tab, 44 ref.

Descriptors: *Groundwater pollution, *Leaching, *Nitrates, *Nonpoint pollution sources, *Path of pollutants, *Soil water, Convection, Denitrification, Diffusion, Fertilizers, Model studies, Plant uptake, Solute transport, Statistical models.

Nitrates, because they are so mobile in soil, will often present a potential threat to groundwater whenever they are used as a fertilizer or when nitrogen is discharged onto land surfaces by septic tanks or under feedlots. Descriptions of extreme variability of soil properties which govern chemical movement, and modeling approaches are only now being developed to incorporate variability into transport predictions. A branch of statistical analysis known as geostatistics has emerged as a major tool in designing sampling strategies to maximize the information about average values and variances of soil parameters, and could in the future be extended to produce large scale soil maps which identify areas with high leaching potential. Movement of any dissolved ion, such as nitrate, through soil is governed by two mechanisms: convection or mass flow of the chemical with moving soil solution, and diffusion of the chemical within the solution. In addition, because the convective flow paths for the solution are never known exactly, a volume-averaged expression is used to describe mass flow. The extra three-dimensional convection which has been averaged out of the mass flow expression is included as a separate solute transport mechanism, called hydrodynamic dispersion. The size and importance of this term depends greatly on the space scale over which convection has been averaged. There are a number of sources of nitrogen in soil which can be transformed into nitrate: plant uptake and denitrification. There are a number of different approaches used to model the transport of a mobile solute, such as nitrate through soil. It is useful to divide these approaches into two groups, process models and stochastic models. Process models develop a description of transport based on mass conservation and flux laws, leading to differential equations to predict values of the water and solute variables as functions of position and time. In contrast, stochastic models describe the variables as random functions, which depend on the distribution of values of the soil properties which determine their movement. Rather than predict values of concentration as a function of position and time, stochastic models predict concentration averages and variances, and are used to calculate the probability of having a given value appear at a given depth or time. (See also W91-06717) (Lantz-PTT)
W91-06736

PROPER ACCOUNTING FOR N IN CROPPING SYSTEMS.
Agricultural Research Service, Lincoln, NE.
For primary bibliographic entry see Field 3F.
W91-06737

FERTILIZER NITROGEN MANAGEMENT.
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W91-06738

ESTIMATION OF N BUDGETS FOR CROPS.
Agricultural Research Service, Lincoln, NE.
For primary bibliographic entry see Field 3F.
W91-06739

IMPACT OF SOIL MANAGEMENT PRACTICES ON NITROGEN LEACHING.
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W91-06740

CROPPING SYSTEMS: ECOLOGY AND MANAGEMENT.
Minnesota Univ., St. Paul. Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W91-06741

LINKAGES WITH GROUND WATER.
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2F.
W91-06743

TRANSFORMATIONS AND MOVEMENT OF NITRATE IN AQUIFER SYSTEMS.
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Lab.
R. R. Lowrance, and H. B. Pionke.
IN: Nitrogen Management and Ground Water Protection. Developments in Agricultural and Managed-Forest Ecology 21. Elsevier, New York, NY. 1989. p 373-392, 4 fig, 60 ref.

Descriptors: *Aquifers, *Chemical interactions, *Fate of pollutants, *Groundwater chemistry, *Nitrates, *Path of pollutants, Biological treatment, Chemical treatment, Denitrification, Groundwater pollution, Groundwater recharge, Nitrogen compounds, Physical treatment.

Nitrate in groundwater is subjected to a variety of physical, chemical, and biological processes which lead to changes in concentration or mass of nitrate solution. The processes leading to changes in nitrate concentration in groundwater and the effects of these processes on different aquifers are reviewed. Physical processes such as dilution change nitrate concentrations, but generally do not change the mass of nitrate in the aquifers. Biological denitrification rates are controlled by redox conditions, available carbon and denitrifier populations. Chemical denitrification rates are controlled by redox conditions and available reduced ion species such as ferrous iron. Denitrification will lead to increases in dissolved dinitrogen gas or nitrous oxide in groundwater. Dissimilatory nitrate reduction and immobilization are also of potential importance in reducing the mass of nitrate. Once nitrate has entered groundwater, heterogeneities within the aquifer can decrease either concentration or mass. Recharge by water with lower nitrate concentration causes dilution. Movement into confined aquifers can lead to chemical evolution of the groundwater toward oxygen depletion and more reduced conditions. Movement into less permeable areas or carbon-rich portions of the aquifer can promote nitrate reduction through denitrification. Case studies of regional aquifer systems have demonstrated that nitrate disappearance occurs in contaminated aquifers although numerous interpretations of removal mechanisms are possible. Most studies used indirect measurements to indicate that biological denitrification does or can reduce nitrate levels in groundwater. Studies of a contaminated aquifer on Cape Cod, Massachusetts, demonstrated high rates of biological denitrification. The restoration of nitrate contaminated aquifers has not been attempted by may be accomplished under certain conditions by enhancing biological or chemical denitrification rates. Increasing dissolved organic carbon and other nutrients in a contaminated aquifer would probably increase denitrification due both to the increased carbon supply and more anaerobic conditions. (See also W91-06717) (Author's abstract)
W91-06744

ORGANOCHLORINE RESIDUES IN FISH FROM LAKE VICTORIA, KENYA.
Nairobi Univ. (Kenya). Dept. of Public Health, Pharmacology and Toxicology.
E. S. Mitema, and F. K. Gitau.
African Journal of Ecology AJOEDE, Vol. 28, No. 3, p 234-239, September 1990. 3 tab, 27 ref.

Descriptors: *Africa, *Chlorinated hydrocarbon insecticides, *Fish, *Path of pollutants, *Pesticide residues, *Pesticides, Agricultural chemicals, Aldrin, Benzene hexachloride, DDD, DDE, DDT, Dieldrin, Kenya, Lake Victoria, Lindane, Organochlorine pesticides, Perch.

Eighty-two samples of either nile perch fish fat or muscle were collected from the Kenyan region of Lake Victoria for detection of organochlorine residues. Nine organochlorine residues were detected in the following percentages of samples: alpha-benzene hexachloro isomers, 40%; beta-benzene hexachloro isomers, 40%; gamma-benzene hexachloro isomers/lindane, 4%; aldrin, 9%; dieldrin, 1%; p,p'-DDE, 73%; p,p'-DDD, 9%; o,p'-DDT, 1%; and p,p'-DDT, 11%. All levels of organochlorine residues were below the Extraneous Residue Limit (ERL), except for one sample of fish fat which contained 4.51 ppm of sum DDT above ERL. There was a higher level of organochlorines in fish from Mbita than in those from Luanda fishing point, possibly due to previous use of organochlorine insecticides to control tsetse flies and other insects in Mbita. It is suggested that periodic assay of organochlorine residues should be performed on fish in order to monitor insecticide pollution of the lake. (MacKeen-PTT)
W91-06746

MODEL FOR EXCHANGE OF ORGANIC CHEMICALS AT FISH GILLS: FLOW AND DIFFUSION LIMITATIONS.
Environmental Research Lab.-Duluth, MN.
R. J. Erickson, and J. M. McKim.
Aquatic Toxicology AQTODG, Vol. 18, No. 4, p 175-198, December 24, 1990. 5 fig, 1 tab, 40 ref.

Descriptors: *Fish, *Fish physiology, *Model studies, *Organic compounds, *Path of pollutants, Diffusion, Flow, Gills, Guppies, Hydrophobicity, Mathematical models, Trout.

A mathematical model for the exchange of neutral organic chemicals at fish gills was formulated based on limitations imposed by flows of water and blood to the gills, diffusion barriers defined by gill morphology, and chemical binding relationships within water and blood. This model was parameterized independently of exchange measurements and validated against datasets on the relationship of chemical uptake rates for large rainbow trout and small guppies to chemical hydrophobicity. This model was found to closely predict the magnitude and trends of observed gill uptake rates in these datasets, predictions deviating from observed values by no more than a factor of two over a range of octanol:water partition coefficients from 2 to >1,000,000. Elimination rates for small guppies were also predicted. This analysis suggests that gill exchange can be understood and predicted on the basis of fundamental physiological and morphological variables. (Author's abstract)
W91-06747

PH DEPENDENT ACCUMULATION OF PCP IN AQUATIC MICROCOSMS WITH SEDIMENT.
Ohio State Univ., Columbus. Dept. of Entomology.
S. W. Fisher.
Aquatic Toxicology AQTODG, Vol. 18, No. 4, p 199-218, December 24, 1990. 2 fig, 10 tab, 31 ref.

Descriptors: *Bioaccumulation, *Chlorinated aromatic compounds, *Path of pollutants, *Pesticides, *Sediment contamination, Aquatic microcosms, Fate of pollutants, Hydrogen ion concentration, Organic carbon, Pentachlorophenol, Sediments.

The fate of pentachlorophenol (PCP) in aquatic microcosms, consisting of three trophic levels and held under varying conditions of pH and sediment type, was assessed. The pH was set at 4, 6, or 8, with an organic sediment (3% organic carbon) as a substrate. The distribution of PCP in the microcosm media and organisms varied significantly as environmental conditions changed. There was significantly more PCP (or phenate ion) in the water at pH 8 than at pH 6 or 4 in both the organic and inorganic systems. However, accumulation of PCP in most of the microcosm organisms was significantly greater at pH 4, followed by 6 and then 8. Partitioning of PCP into organic sediment followed the same trend, with the highest amounts of PCP appearing in sediment at pH 4. The organic carbon content of sediment was important in determining partitioning into sediment; the 3% organic carbon sediment sorbed significantly more PCP than the 0% organic carbon sediment. In addition, the organisms in the 3% organic carbon sediment microcosms accumulated significantly less PCP than did those in the 0% organic carbon systems. The 3% organic carbon sediment also appeared to facilitate the breakdown of PCP in sediment and water. These data indicate that hazard assessments should not be based on aqueous levels of PCP unless pH is considered. (Author's abstract)
W91-06748

INTERFERENCE OF POLYCHLORINATED BIPHENYLS (CLOPHEN A50) WITH GAMETOGENESIS IN THE SEA STAR, ASTERIAS RUBENS L.
Utrecht Rijksuniversiteit (Netherlands). Research Group for Aquatic Toxicology.
For primary bibliographic entry see Field 5C.
W91-06750

PRENATAL EXPOSURE TO METHYL MERCURY AMONG GREENLANDIC POLAR INUITS.
Aarhus Univ. (Denmark). Dept. of Toxicology.
J. C. Hansen, U. Tarp, and J. Bohm.
Archives of Environmental Health AEHLAU, Vol. 45, No. 6, p 355-358, November/December 1990. 1 fig, 1 tab, 19 ref.

Descriptors: *Greenland, *Human physiology, *Mercury, *Methylmercury, *Path of pollutants, *Population exposure, *Water pollution effects, Blood samples, Fish food, Polar Inuits, Prenatal exposure.

During the period of 1982 to 1988, 37 paired samples of blood from Inuit women and their newborn children were collected in North Greenland. The samples were analyzed for whole blood content of total mercury and for content of methyl mercury. In maternal blood, 80% of the total mercury was found to be methylated in contrast to 98% in cord blood. Concentrations of methyl mercury in maternal and cord blood were significantly correlated, and the mean ratio between fetal and maternal blood methyl mercury was 1.9. Concentrations of methyl mercury in cord blood were closely related to the marine food intake of the mothers. Eighty-four percent of the mothers had blood concentrations of methyl mercury above 0.11 micromol/L (23 microg/L), which corresponds to the provisional limit of tolerable intake set by the World Health Organization. This indicates that the majority of the pregnant Inuit women have an unacceptably high intake of methyl mercury. (Author's abstract)
W91-06764

RADIUM AND RADON IN CHARLOTTE HARBOR ESTUARY, FLORIDA.
Geological Survey, Tampa, FL.
R. L. Miller, T. F. Kraemer, and B. F. McPherson.
Estuarine, Coastal and Shelf Science ECSSD3, Vol. 31, No. 4, p 439-457, October 1990. 8 fig, 2 tab, 31 ref.

Descriptors: *Estuaries, *Florida, *Path of pollutants, *Radioisotopes, *Radium, *Radon, Charlotte Harbor, Desorption, Estuarine environment, Groundwater movement, Sediments.

Radium-226 and radon-222 activities are greater in the estuarine waters of northern Charlotte Harbor and the lower tidal Peace and Myakka Rivers, Florida, than in either the freshwater reaches of the rivers or waters of the lower estuary and the Gulf of Mexico. The activity of Ra-226 in the tidal rivers increases with decreasing river inflow, with a maximum value of 548 dpm/100 L measured in the tidal Myakka River. The source of the high activity of Ra-226 and Rn-222 is predominantly groundwater inflow. Because of the large groundwater input, the contribution of Ra-226 from suspended and bottom sediments is a smaller fraction of the total Ra-226 input than in many other estuaries. Although groundwater Ra-226 activity in the area varies widely, it is estimated that artesian groundwater inflow to the tidal rivers is similar in magnitude to the flow of rivers above the tidal reach during the dry season. (Author's abstract)
W91-06770

EFFECTS OF MERCURY, SELENIUM, AND ORGANOCHLORINE CONTAMINANTS ON REPRODUCTION OF FORSTER'S TERNS AND BLACK SKIMMERS NESTING IN A CONTAMINATED TEXAS BAY.
Patuxent Wildlife Research Center, Laurel, MD.
For primary bibliographic entry see Field 5C.
W91-06773

PRODUCTIVITY, DIET, AND ENVIRONMENTAL CONTAMINANTS IN BALD EAGLES NESTING NEAR THE WISCONSIN SHORELINE OF LAKE SUPERIOR.
Wisconsin Univ.-Stevens Point. Coll. of Natural Resources.
For primary bibliographic entry see Field 5C.
W91-06774

POLYCHLORINATED BIPHENYL CONGENERS IN BLOOD OF WISCONSIN SPORT FISH CONSUMERS.
Wisconsin Univ.-Madison. Lab. of Hygiene.
W. Sonzogni, L. Maack, T. Gibson, D. Degenhardt, and H. Anderson.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 56-60, 1991. 3 tab, 22 ref.

Descriptors: *Blood, *Path of pollutants, *Pesticide residues, *Polychlorinated biphenyls, *Sport fishing, *Wisconsin, Bioassay, Fish, Food chains, Pollutant identification, Population exposure.

As part of a study to evaluate the effect of chemical contaminants of Wisconsin sport fish consumers, measurements were made of polychlorinated biphenyl (PCB) congeners in human blood sera. A high resolution gas chromatography procedure was employed, with 13 individual congeners used as standards. Analytical recoveries and precision were greater than 90% and replicates were always within +/-30%. Total concentrations, obtained by summing quantified congeners, ranged from 0.6 to 27.1 micrograms/L. Conventional packed column PCB analysis, conducted on a subset of samples, gave higher total PCB results. On a congener specific basis (IUPAC number, structure) congeners 153 (245-245), 138 (234-245), 180 (2345-245) and 118 (245-34) were found most often. These congeners have been reported to be prominent in other matrices. Of the congeners found, 118, 138, and possibly 180 are potentially the most toxic (based on current toxicological information). (Author's abstract)
W91-06775

BIOMAGNIFICATION OF POLYCHLORINATED BIPHENYLS, TOXAPHENE, AND DDT COMPOUNDS IN A LAKE MICHIGAN OFFSHORE FOOD WEB.
Michigan Univ., Ann Arbor. Center for Great Lakes and Aquatic Sciences.
M. S. Evans, G. E. Noguchi, and C. P. Rice.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 87-93, 1991. 1 fig, 3 tab, 26 ref. Office of Sea Grant, NOAA Grant NA80AA-D-00072 and Grant NA85AA-D-SG045C, and EPA Grant R-812311-0109.

Descriptors: *Biomagnification, *DDT, *Fish food organisms, *Food chains, *Lake Michigan, *Path of pollutants, *Polychlorinated biphenyls, *Sculpin, *Toxaphenes, Amphipods, Benthic fauna, Biological magnification, Chlorinated hydrocarbon insecticides, Fish, Halogenated pesticides, Lake sediments, Metabolites, Opossum-shrimp, Plankton, Pollutant identification, Sediment contamination.

The biomagnification of polychlorinated biphenyls (PCB), toxaphene, and the DDT family of metabolites was investigated in the epibenthic Mysis relicta (mysid), the benthic Pontoporeia hoyi (amphipod), plankton, particulate flux, surficial sediments, and Myoxocephalus thompsoni (deepwater sculpin) in southeastern Lake Michigan. DDE was the most strongly biomagnified compound, increasing 28.7 times in average concentration from plankton to fish. PCB increased 12.9 times in average concentration from plankton to fish while toxaphene increased by an average factor of 4.7. Particle flux was comprised of lower chlorinated PCB homologues (average chlorine number = 3.8) than the biota (4.5 to 5.0) and sediments (4.6) possibly reflecting strong influences from atmospheric deposition and/or zooplankton egestion. The percent of higher chlorinated PCB homologues (5 and 6 chlorine atoms per PCB molecule) increased from 54 to 56% of the total PCB in plankton and M. relicta, to 61% in P. hoyi, to 74% in sculpins. Amphipods contained greater concentrations than mysids of PCB, DDT residues, and toxaphene, possibly reflecting differences in habitat (benthic vs epibenthic) and diet (detritus vs plankton). Based on estimates of average areal biomass and contaminant concentration, offshore Lake Michigan P. hoyi populations contain approximately 15.0 times as much toxaphene, 9.5 times as much total DDT, and 12.0 times as much PCB as the offshore M. relicta populations. Thus, amphipods may represent a greater reservoir than mysids for contaminant storage and subsequent recycling in offshore Lake Michigan. (Author's abstract)
W91-06778

CADMIUM CONCENTRATIONS IN THE FRESHWATER MUSSEL (ELLIPTIO COMPLANATA) AND THEIR RELATIONSHIP TO WATER CHEMISTRY.
Trent Univ., Peterborough (Ontario). Environmental Centre.
J. Campbell, and R. D. Evans.
Archives of Environmental Contamination and

Toxicology AECTCV, Vol. 20, No. 1, p 125-131, 1991. 5 fig, 3 tab, 27 ref.

Descriptors: *Bioaccumulation, *Bioavailability, *Cadmium, *Canada, *Heavy metals, *Mollusks, *Mussels, *Ontario, *Path of pollutants, Chemical analysis, Hydrogen ion concentration, Lakes, Organic carbon, Regression analysis, Sediment contamination, Tissue analysis.

Concentrations of cadmium were determined in freshwater mussels (Elliptio complanata) from 21 small lakes in south-central Ontario The average Cd concentrations ranged from 0.5 to 7.5 micrograms/g dry weight. A poor correlation between the concentration of Cd in lakewater and the concentration of Cd in the organisms was observed. Concentration of Cd in the sediments was not a useful predictor. Thus, it is hypothesized that the availability of Cd varies among the 21 lakes. In an effort to test this hypothesis, the relationships between organism concentrations and water chemistry parameters that have the potential to alter Cd availability including pH, calcium (Ca), total organic carbon (TOC) and total inorganic carbon (TIC) were examined. The strongest relationship was found between Cd concentration in the mussels and water column pH, suggesting that hydrogen ions are replacing Cd ions in complexes and increasing the amount of free Cd available to the organisms. Correlations between pH and other water chemistry parameters make it difficult to test this hypothesis. A multiple regression model was developed incorporating pH, Ca, TOC, and TIC which explained 69% of the variance in Cd concentrations. (Author's abstract)
W91-06783

DEGRADATION OF DIFLUBENZURON AND ITS CHIEF METABOLITES IN SOILS PART III: FATE OF 2,6-DIFLUOROBENZOIC ACID.
Duphar B.V., The Hague (Netherlands). Crop Protection Div.
W. B. Nimmo, K. D. Joustra, and A. G. M. Willems.
Pesticide Science PSSCBG, Vol. 29, No. 1, p 39-45, 1990. 2 fig, 4 tab, 8 ref.

Descriptors: *Biodegradation, *Degradation products, *Diflubenzuron, *Fate of pollutants, *Pesticide kinetics, Carbon radioisotopes, Clays, Liquid chromatography, Metabolites, Pesticide residues, Sand, Separation techniques, Soil analysis.

A solution of C14-DFBA (2,6-difluorobenzoic acid) was added to soil samples (sandy clay and humous sand). Samples were stored in darkness at 24 C and then extracted at room temperature. DFBA, one of the two primary diflubenzuron metabolites, was rapidly and completely degraded in soil. A decrease to 50% of the initial DFBA concentration was reached after about 9 days in the humus sand and after about 12 days in the sandy clay. DFBA had almost completely disappeared in the humus sand after 32 days, the last sampling time. (C14)Carbon dioxide was an ultimate product of the ring-(C14)-labeled compound. The amounts of C14 and (C14)DFBA in the extracts differed from each other, pointing to the existence of extractable degradation products. It was observed during the clean-up procedures for high performance liquid chromatography (HPLC) analysis that a small percentage of the radioactivity could not be extracted from the soil. This percentage increased with the incubation time of the soil, but remained less than 10% of the initially applied radioactivity. (VerNooy-PTT)
W91-06792

LEACHING POTENTIAL AND DECOMPOSITION OF FLUROXYPYR IN SWEDISH SOILS UNDER FIELD CONDITIONS.
Sveriges Lantbruksuniversitet, Uppsala. Div. of Water Management.
L. R. Bergstrom, A. S. McGibbon, S. R. Day, and M. Snel.
Pesticide Science PSSCBG, Vol. 29, No. 4, p 405-407, 1990. 4 fig, 3 tab, 12 ref.

Descriptors: *Decomposition, *Fate of pollutants, *Fluroxypyr, *Herbicides, *Leaching, *Microbial degradation, *Path of pollutants, *Soil contamination, Chemical properties, Clays, Field tests, India, Lysimeters, Metabolism, Pesticide residues, Pollutant identification, Sand, Soil properties, Spatial distribution, Sweden.

The mobility and decomposition of the herbicide fluroxypyr (4-amino-3,5-dichloro-6-fluoro-2-pyridyloxacetic acid) was studied under field conditions in a sandy soil and a clay soil. Leachate was collected in lysimeters with undisturbed soil (sand) and in tile-drained plots (clay). Soil samples to a depth of one meter were also collected in both soils to characterize the temporal depth distribution of fluroxypyr in the profiles. The herbicide was applied as the 1-methylheptyl ester of fluroxypyr at two rates, 187.5 and 375.0 g a.e./ha, representing the normal and double dose of the compound used for spring cereals. Some lysimeters received supplementary watering. Only two leachate samples (one from each soil) had concentrations of fluroxypyr above the detection limit (1 microgram/L), i.e., 2 and 5 micrograms/L. Both samples were collected within two months after application, when less than 2 mm of drainage had been collected. The methyl heptyl ester of fluroxypyr was not found in any of the samples. Fluroxypyr levels above the detection limit in soil (5 micrograms/kg dry soil) were never found below the topsoil (0.2 m) in the clay profile, while, in the sandy profile, levels just above the detection limit were found occasionally in deeper soil layers. Concentrations were reduced to undetectable or very low levels within three months after spraying. (Author's abstract)
W91-06794

DEGRADATION OF PENDIMETHALIN BY SOIL FUNGI.
Bidhan Chandra Krishi Viswa Vidyalaya, Mohanpur (India). Dept. of Agricultural Chemistry and Soil Science.
A. S. Barua, J. Saha, S. Chaudhuri, A. Chowdhury, and N. Adityachaudhury.
Pesticide Science PSSCBG, Vol. 29, No. 4, p 419-425, 1990. 5 fig, 2 tab, 10 ref.

Descriptors: *Biodegradation, *Degradation products, *Fate of pollutants, *Herbicides, *Pendimethalin, *Soil fungi.

Pendimethalin (N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine; Stomp(TM)) is one of the several members of the class of dinitroaniline herbicides which has been officially recommended in India as a soil-applied pre-emergence herbicide, and it is reported to have selective weed control properties. In order to study the environmental degradation of this herbicide after its application to the field and ensure safer use, experiments were conducted on the degradation of pendimethalin by several soil fungi. The soil fungi Aspergillus flavus, A. terreus, Fusarium solani, F. oxysporum, Penicillium citrinum and P. simplicissimum effectively degraded pendimethalin supplied as the sole carbon source in mineral solution. All six fungal isolates were able to degrade 60% or more of the pendimethalin within 15 days. Degradation of pendimethalin by F. solani resulted in the isolation and identification of N-propyl-3-methyl-4-hydroxy-2,6-dinitroaniline, N-(1-ethylpropyl)-2-amino-6-nitro-3,4-xylidine and 2,6-dinitro-3,4-xylidine. The partial pathways involved in the degradation of pendimethalin have also been proposed; the main metabolic pathways involved partial N-dealkylation followed by ring hydroxylation, nitro-group reduction and complete N-dealkylation. (VerNooy-PTT)
W91-06795

OFF-TARGET DEPOSITS AND BUFFER ZONES REQUIRED AROUND WATER FOR AERIAL GLYPHOSATE APPLICATIONS.
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
For primary bibliographic entry see Field 5G.
W91-06796

FIELD MOVEMENT AND PERSISTENCE OF FENAMIPHOS IN DRIP-IRRIGATED PINEAPPLE SOILS.
Hawaii Univ. at Manoa, Honolulu. Dept. of Agronomy and Soil Science.
R. C. Schneider, R. E. Green, W. J. Apt, D. P. Bartholomew, and E. P. Caswell.
Pesticide Science PSSCBG, Vol. 30, No. 3, p 243-257, 1990. 8 fig, 4 tab, 26 ref.

Descriptors: *Fenamiphos, *Hawaii, *Irrigation, *Organophosphorus pesticides, *Path of pollutants, *Pesticide residues, *Soil contamination, Application rates, Degradation products, Drip irrigation, Field tests, Leaching, Pineapples, Root zone, Soil analysis.

The persistence and mobility of fenamiphos, an organophosphate nematicide, and its toxic oxidation products in soil with pineapple cropping were studied in three field experiments on the islands of Oahu and Lanai (Hawaii), and by sampling three commercial fields on Oahu. Fenamiphos was applied by drip irrigation after planting, following pre-plant application of 1,3-dichloropropene (1,3-D) in most treatments. The Oahu experiments, conducted in highly weathered Oxisol and Ultisol soils, evaluated the impact of restricted irrigation to reduce leaching and also the effect of 1,3-D on fenamiphos behavior. Total toxic residue (TTR) concentrations of 1000 micrograms/kg or greater were maintained in the root-zone with fenamiphos applications of 3.4 kg/ha tri-monthly on the Oxisol (Kunia site) and bi-monthly on the Ultisol (Whitmore site). The relatively high applications, along with weekly irrigations and unseasonably high rainfall, resulted in leaching of fenamiphos TTR out of the root-zone with concentrations between 10 and 100 micrograms/kg at 3 m depth. Reduced leaching with restricted irrigation was evident in the early months of both Oahu experiments. The potential to minimize leaching of fenamiphos by reduced application rates and limited irrigation during rainy periods was evident from nematicide concentration profiles measured on three commercial pineapple fields in Oahu; little fenamiphos TTR was detectable below 1 m. (Author's abstract)
W91-06797

LOCATING LAGOON SEEPAGE WITH RADAR AND ELECTROMAGNETIC SURVEY.
Clemson Univ., SC. Dept. of Agricultural Engineering.
D. E. Brune, and J. Doolittle.
Environmental Geology and Water Sciences EGWSEI, Vol. 16, No. 3, p 195-207, November/December 1990. 14 fig, 32 ref.

Descriptors: *Conductivity, *Data acquisition, *Ground penetrating radar, *Path of pollutants, *Radar, *Remote sensing, *Seepage loss, *Waste treatment, *Wastewater lagoons, Animal wastes, Electrical studies, Farm lagoons, Geophysical methods, Geophysical surveys, Groundwater pollution, Leachates, Plumes, Sampling, Seepage, Soil analysis, Surveys, Terrain analysis, Waste disposal.

The use of lagoons as a treatment technique for managing animal waste has become a widespread and common practice. Lagoons provide an economical means of treating highly concentrated wastes from confined livestock operations. However, some areas in the lagoon bottom do not seal and result in pollutant plumes that can contaminate groundwater downgradient from the lagoon. The current study investigates the use of ground-penetrating radar (GPR) and electromagnetic terrain conductivity (EM) surveys as possible techniques for determining the presence and extent of groundwater contamination from leachate plumes emanating from animal waste lagoons. Systematic soil sampling was conducted at representative sites in South Carolina using the GPR and EM on rectangular grids whose size depended on lagoon size, accessibility, and available time and manpower. The results of the investigation revealed that EM could be a very useful tool in locating and defining the magnitude of seepage from animal waste lagoons. EM and GPR were complimentary geophysical techniques and a synergistic approach was recommended. GPR results were more site specific and interpreter dependent, making the use of the GPR instrument, as a stand-alone instrument for

this application more restricted. Research currently underway may quantify the impact of animal agriculture upon groundwater supplies. (Korn-PTT)
W91-06801

DISTRIBUTION AND BIOACCUMULATION OF SELENIUM IN AQUATIC MICROCOSMS.
National Fisheries Contaminant Research Center, Columbia, MO.
J. M. Besser, J. N. Huckins, E. E. Little, and T. W. La Point.
Environmental Pollution ENPOEK, Vol. 62, No. 1, p 1-12, 1990. 2 fig, 4 tab, 19 ref.

Descriptors: *Bioaccumulation, *Daphnia, *Macrophytes, *Path of pollutants, *Periphyton, *Selenium, *Sorption, Accumulation, Aquatic environment, Experimental data, Experimental design, Isotope studies, Organic matter, Organometals, Radioisotopes, River sediments, Sediment analysis, Sediment contamination, Sediment-water interfaces, Sediments, Sulfates, Toxicity.

Closed-system microcosms were used to study factors affecting the fate of selenium (Se) in aquatic systems. Distribution and bioaccumulation of Se varied among sediment types and Se species. A mixture of dissolved 73Se species (selenate, selenite, and selenomethionine) was sorbed more rapidly to fine-textured, highly organic pond sediments than to sandy riverine sediments. Sulfate did not affect the distribution and bioaccumulation of 75Se over the range 80-180 mg SO4/liter. When each Se species was labeled separately, selenomethionine was lost from the water column more rapidly than selenate or selenite. Selenium lost from the water column accumulated primarily in sediments, but volatilization was also an important pathway for loss of Se added as selenomethionine. Loss rates of dissolved Se residues were more rapid than rates reported from mesocosm and field studies, suggesting that sediment:water interactions are more important in microcosms than in larger test systems. Daphnids accumulated highest concentrations of Se, followed by periphyton and macrophytes. Selenium added as selenomethionine was bioaccumulated preferentially compared to that added as selenite or selenate. Organoselenium compounds such as selenomethionine may thus contribute disproportionately to Se bioaccumulation and toxicity in aquatic organisms. (Author's abstract)
W91-06803

GEOCHEMICAL PARTITIONING OF CO, CR, FE, SC, AND ZN IN POLLUTED AND NON-POLLUTED MARINE SEDIMENTS.
Democritos Nuclear Research Center, Athens (Greece).
M. Angelidis, and A. P. Grimanis.
Environmental Pollution ENPOEK, Vol. 62, No. 1, p 31-46, 1990. 5 fig, 2 tab, 27 ref.

Descriptors: *Geochemistry, *Marine pollution, *Marine sediments, *Path of pollutants, *Sediment contamination, *Trace elements, Analytical techniques, Chemical interactions, Chemical reactions, Chromium, Cobalt, Fate of pollutants, Fertilizers, Greece, Industrial wastewater, Iron, Organic carbon, Sample preparation, Scandium, Separation techniques, Trace metals, Wastewater, Zinc.

The Northern Saronikos Gulf is receiving untreated domestic and industrial wastewater from the greater Athens area, mainly through the Athens Sewage Outfall (ASO). In order to investigate the partitioning of the trace elements in surface sediments from the Saronikos Gulf into different geochemical fractions, a sequential extraction technique was employed for the present study. The sequential extraction method classifies the trace elements in the sediments (i.e., Co, Cr, Fe, Sc, and Zn) in terms of a reducible fraction, an oxidizable fraction, and a residual fraction. The results of the study revealed that, with the exception of Sc, the metal content in the reducible and oxidizable fractions increased in the polluted sediments near the ASO and a fertilizer plant (FP). In the non-polluted sediments, the residual fraction was the most important carrier for all metals examined. Oxidizable Cr and Zn correlated well with the organic carbon content of the sediments. However, the reducible fraction (mainly Fe/Mn hydroxides) was the most important sink for Co, Cr, Fe, and Zn in the polluted sediments near the ASO. Finally, the pyrite-rich wastes from the FP were found to influence the geochemical partitioning of the metals examined in the sediments in front of the FP and, partially, in the sediments near the ASO. (Author's abstract)
W91-06805

FATE OF TRACE METALS DURING THE METAMORPHOSIS OF CHIRONOMIDS (DIPTERA, CHIRONOMIDAE).
Amsterdam Univ. (Netherlands). Dept. of Fundamental and Applied Ecology.
K. R. Timmermans, and P. A. Walker.
Environmental Pollution ENPOEK, Vol. 62, No. 1, p 73-85, 1990. 4 fig, 17 ref.

Descriptors: *Bioaccumulation, *Cadmium, *Copper, *Growth stages, *Midges, *Path of pollutants, *Trace metals, *Zinc, Animal physiology, Aquatic environment, Excretion, Larvae, Sediments, The Netherlands.

Chironomid larvae, which are dominant organisms in aquatic sediments, can accumulate substantial amounts of trace metals. Chironomids are holometabolic insects with terrestrial imagines and therefore, transport of trace metals from the aquatic to the terrestrial environment may occur after emergence. The fate of the trace metals zinc, cadmium, and copper during the metamorphosis of chironomids was studied under field and experimental conditions. Field observations demonstrated a significant decrease in the trace metal body burden of larvae and imagines of Stictochironomus histrio Fabricius. No such differences were noted between successive developmental stages of Chironomus anthracinus Zett. The exuviae of both species contained small amounts of trace metals. Experiments, in which larvae of S. histrio and C. riparius Meigen were individually exposed, showed that larvae of both species accumulated substantial amounts of Zn and Cd. For these metals, a transfer to pupae and imagines occurred. However, pupae had a lower body burden than larvae, and imagines a lower body burden than the pupae. Copper was also accumulated in the larvae, but it was excreted almost completely before the pupal stage. The process of trace metal residue elimination could be explained both by physiological changes taking place during the metamorphosis, as well as the shedding of the exoskeleton when molting from larva to pupa (larval skin), and from pupa to adult midge (exuvium). (Author's abstract)
W91-06807

ATMOSPHERIC DEPOSITION OF ACID, HEAVY METALS, DISSOLVED ORGANIC CARBON , AND NUTRIENTS IN THE DUTCH DELTA AREA IN 1980-1986.
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
V. D. Nguyen, A. G. A. Merks, and P. Valenta.
Science of the Total Environment STENDL, Vol. 99, No. 1/2, p 77-91, December 1990. 5 fig, 4 tab, 25 ref.

Descriptors: *Acid rain, *Air pollution, *Dissolved organic carbon, *Heavy metals, *Nutrients, *Path of pollutants, *Pollutant identification, *Precipitation, *Water pollution sources, Ammonium, Annual distribution, Cadmium, Cobalt, Copper, Hydrogen ion concentration, Lead, Nitrates, Seasonal variation, Statistical analysis, Sulfates, Temporal distribution, The Netherlands, Zinc.

In a 7-year program established to investigate the deposition of pollutants from the atmosphere, wet precipitation samples were collected in specially designed samplers at two sampling locations in the Delta area of The Netherlands. Average monthly and yearly concentrations and depositions of acid, (H3O(+)), heavy metals (Cd, Pb, Zn, Cu, and Co), nutrients (NH4(+), NO3(-), and SO4(2-)), and dissolved organic carbon (DOC) in the rainwater and snow samples were calculated by taking cumulative samples on a weekly basis. The data for the annual mean concentrations showed no significant temporal trend for ammonium and nitrate. However, a slight decrease in H3O(+) and DOC was observed. The decrease in H3O(+) was believed to be the result of the lower concentration of H3O(+) and the lower amount of precipitation. The wet deposition of sulfate showed a slightly decreasing trend over the seven year sampling program with 90% of the SO2 emission originating from fossil-fuel-burning power plants and heavy industry. Levels of nitrate in wet precipitation were below detection limits. Statistical evaluation of the concentrations of the ecotoxic heavy metals in wet precipitation revealed the sequence of average concentrations to be as follows: Zn > Pb > Cu > Ni > Cd > Co. There were no statistically significantly temporal trends for Cd and Zn while a slight decrease for Pb and Cu deposition was observed in 1986. The ecotoxic heavy metals were believed to be emitted into the atmosphere from various industrial sources and from large, diffuse sources such as road traffic and coal burning by households and small industries. (Korn-PTT)
W91-06818

DISSIPATION OF FLURTAMONE IN THREE GEORGIA SOILS.
Georgia Univ., Athens. Dept. of Agronomy.
T. C. Mueller, P. A. Banks, and D. C. Bridges.
Weed Science WEESA6, Vol. 38, No. 4/5, p 411-415, 1990. 3 fig, 2 tab, 25 ref.

Descriptors: *Fate of pollutants, *Groundwater pollution, *Herbicides, *Weed control, Degradation, Georgia, Liquid chromatography, Peanuts, Soil analysis, Soil types.

The dissipation of flurtamone was determined in three Georgia soils in 1987 to 1989. Flurtamone dissipation in soil was initially rapid but gradually slowed throughout the sampling interval. Dissipation was not affected by rate (0.8 or 1.7 kg/ha) or application method, preplant incorporated (PPI) or preemergent (PRE). Dissipation rates were slightly more rapid in the Greenville and Dothan soils than in the Cecil soil, with calculated initial half-lives for each respective soil being 6 to 7, 8 to 10, and 9 to 23 days. There was no effect of previous flurtamone exposure on the dissipation rate in soil at any location. The rapid dissipation of flurtamone from the 0-10-cm soil zone, coupled with no detection in the 10-18-cm soil zone 42 days after treatment suggested that the potential for flurtamone movement to groundwater is minimal. (Doyle-PTT)
W91-06828

DEGRADATION AND FIELD PERSISTENCE OF IMAZETHAPYR.
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. J. Goetz, T. L. Lavy, and E. E. Gbur.
Weed Science WEESA6, Vol. 38, No. 4/5, p 421-428, 1990. 4 fig, 7 tab, 10 ref.

Descriptors: *Fate of pollutants, *Herbicides, *Microbial degradation, *Photolysis, Carbon radioisotopes, Isotopic tracers, Liquid chromatography, Soil moisture, Soil temperature, Soil types, Volatility.

The volatilization, photolysis, microbial degradation, and field persistence of imazethapyr were studied using formulated and C 14 labeled imazethapyr. Volatilization losses from soil were less than 2%. Photodecomposition losses of up to 8% occurred from soil and up to 52% from a glass slide with no soil. Significantly greater photodecomposition occurred with chain-labeled than ring labeled C 14 imazethapyr. The amount of C-14 CO2 evolution from soil treated with either ring or chain labeled C-14 imazethapyr was not significantly different. The total C-14 CO2 evolved from the soils ranged from 2.4 to 3.6% of the total C-14 imazethapyr applied to the soil. However, degradation of imazethapyr from the same soils, as determined by high-pressure liquid chromatography, indicated that 62 to 82% of applied C-14 imazethapyr had been degraded. The degradation rate increased as soil moisture was increased from -100 to -33 kPa. Imazethapyr was more persistent in soil

with higher clay and organic matter content. (Author's abstract)
W91-06830

CONTROL OF NUTRIENT CONCENTRATIONS IN THE SEEKONK-PROVIDENCE RIVER REGION OF NARRAGANSETT BAY, RHODE ISLAND.
Rhode Island Univ., Narragansett. Marine Ecosystems Research Lab.
For primary bibliographic entry see Field 2L.
W91-06838

APPLICATION OF MARINE SEISMIC PROFILING TO A GROUND WATER CONTAMINATION STUDY, ABERDEEN PROVING GROUND, MARYLAND.
Geological Survey, Towson, MD.
B. Hughes.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 97-102, Winter 1991. 5 fig, 10 ref.

Descriptors: *Aberdeen Proving Ground, *Analytical methods, *Chesapeake Bay, *Groundwater pollution, *Hazardous wastes, *Seismic exploration, Geologic surveys, Groundwater modeling, Munitions wastes, Organic solvents, Path of pollutants, Sediment contamination, Sediment sampling.

Continuous high-frequency marine seismic profiling was used to define the extent of geological units in the offshore areas of J-Field, Aberdeen Proving Ground, Maryland, during March and April of 1988. J-Field is an area that was used by the U.S. Army for disposal of chemical warfare agents, munitions, and organic solvents from the 1950's through the 1970's. A major concern at this site is the subsurface migration of hazardous wastes into offshore areas and eventually into the Chesapeake Bay. A 150-foot (45.7 meter) deep paleochannel containing Pleistocene age fluvial and estuarine sediments was identified from boreholes constructed onshore. The paleochannel sediments consist of three lithic units. From bottom to top these units consist of gravel and sand, massive silty and sandy clay, and interbedded sand and clay. The seismic profiles were used to identify the extent of these units and map them in offshore areas. An accurate knowledge of the distribution of the geologic units in onshore and offshore areas is important to the investigation because the coarse-grained paleochannel sediments may provide a preferential flow path for contaminated groundwater and the fine-grained sediments may impede the movement of contaminants into deeper aquifers. (Author's abstract)
W91-06849

REDUCTION OF NITRATE LOADINGS TO GROUND WATER.
Maryland Univ., College Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W91-06851

GROUND WATER CONTAMINATION AT WOOD TREATMENT FACILITIES.
Lockheed Engineering and Sciences Co., Inc., Las Vegas, NV.
J. K. Rosenfeld, and R. H. Plumb Jr.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 133-140, Winter 1991. 5 fig, 4 tab, 6 ref.

Descriptors: *Creosote, *Groundwater pollution, *Path of pollutants, *Wood preservatives, Aromatic hydrocarbons, Arsenic, Chromium, Heavy metals, Organic compounds, Pentachlorophenol, Sampling, Superfund, Trace elements, Wells.

There are more than 40 wood treatment sites on the Environmental Protection Agency's National Priorities List of Superfund sites. It is hoped that finding a consistent chemical fingerprint in contaminated groundwater might lead to a customized set of monitoring parameters for the industry and a way to pinpoint sources of contamination during a regional investigation. The distribution pattern of organic priority pollutants in groundwater samples taken from five wood treatment facilities showed that if a compound was found at one site, it most likely was found at the other sites, as well. The detected contaminants were arranged according to their Target Compound List (TCL) number. The most commonly detected volatiles include benzene (No. 23), toluene (No. 29), ethyl benzene (No. 32) and xylene (No. 34). These simple aromatic hydrocarbons are commonly detected in fuels, but in this case, they probably result from creosote usage, either as low distillation ends, carrier solvents, or possibly degradation products of the more complex aromatics found in creosote. Of the 65 semi-volatile compounds on the TCL, 19 polycyclic and phenolic compounds were found in concentrations as high as 11,000 ppb. These compounds are constituents of creosote, which is a complex mixture whose exact composition depends on the type of coal tar from which it is produced. The search for inorganic fingerprint compounds which contained arsenic, chromium, copper and zinc did not appear to identify any clear inorganic indicators since their distributions were not uniform at all sites; nor did pentachloralphenol (PCP) prove to be reliable as an indicator. Therefore, in terms of monitoring parameters, it is suggested that the semivolatile organic compounds on the TCL should be emphasized in evaluating wood treatment facilities. (Doyle-PTT)
W91-06854

ANALYSIS OF NITRATE-NITROGEN IN GROUND WATER BENEATH UNSEWERED SUBDIVISIONS.
Wisconsin Univ.-Eau Claire.
J. R. Tinker Jr.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 141-150, Winter 1991. 6 fig, 11 tab, 21 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Path of pollutants, *Public health, *Septic tanks, *Water pollution sources, *Wisconsin, Fertilizers, Groundwater movement, Model studies, Septic wastewater, Wells.

Water samples from private water supply wells in five unsewered subdivisions were tested for nitrate-nitrogen to determine the possible impact of septic systems on groundwater quality. Three subdivisions are located in Eau Claire County and two in LaCrosse County, Wisconsin. The nitrate-nitrogen concentrations in the wells were analyzed in relation to groundwater flow direction, the location of septic systems within the subdivision, and the hydrogeologic and physical characteristics of the subdivisions. A comparison of three nitrogen mass balance models helped to identify the possible sources of nitrate-nitrogen in the wells. The results indicate that nitrogen from septic systems and lawn fertilizer cause nitrate-nitrogen to increase in the groundwater beneath the down gradient side of the subdivisions. In three of the five subdivisions the highest nitrate-nitrogen value exceeds the drinking water standard of 10 mg/L. (Author's abstract)
W91-06855

INVESTIGATION OF POSSIBLE CONTAMINATION OF SHALLOW GROUND WATER BY DEEPLY INJECTED LIQUID INDUSTRIAL WASTES.
National Water Research Inst., Burlington (Ontario). Groundwater Contamination Section.
S. Lesage, R. E. Jackson, M. Priddle, P. Beck, and K. G. Raven.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 151-159, Winter 1991. 9 fig, 5 tab, 20 ref.

Descriptors: *Disposal wells, *Groundwater pollution, *Hazardous waste disposal, *Injection wells, *Ontario, *Path of pollutants, Aromatic hydrocarbons, Boreholes, Canada, Chromatography, Monitoring wells.

The possible impact of deep well disposal operations on the groundwater quality in a shallow freshwater aquifer beneath Sarnia, Ontario, Canada was assessed. A monitoring well network of 29 five cm (2 in) diameter piezometers was established in a thin sand and shale aquifer system between 30 and 70 m below ground surface. In addition, a 300m (1000 foot) deep borehole was drilled and instrumented with a Westbay multilevel casing, which permitted sampling of the disposal zone. Because of the breakout of formation liquids in Sarnia and Port Huron, Michigan, in the early 1970s, it was thought that liquid wastes from the disposal zone in bedrock had leaked through numerous abandoned oil, gas, and salt wells in the area into the fresh water aquifer and from there to the surface. Groundwater samples from the shallow monitoring wells and the Westbay multilevel casing were analyzed for volatiles by gas chromatography/mass spectometry (GC/MS). Those volatile aromatics that were conspicuously present in the deep disposal zone e.g., ethyl toluenes and trimethyl benzene, were not detected in shallow monitoring wells. Thus, if contaminants from the disposal zone did indeed migrate to the shallow aquifer, contamination was not widespread and probably consisted mostly of displaced chloride-rich formation waters. (Doyle-PTT)
W91-06856

EFFECT OF LONG-TERM WATER VELOCITY CHANGES ON STREAMBED BIOFILM ACTIVITY.
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
C. J. Gantzer, B. E. Rittmann, and E. E. Herricks.
Water Research WATRAG, Vol. 25, No. 1, p 15-20, January, 1991. 3 fig, 1 tab, 34 ref. University of Illinois Water Resources Center Project Number S-098-ILL.

Descriptors: *Biodegradation, *Biofilms, *Biomass, *Fate of pollutants, Chemical oxygen demand, Mass transport, Modeling studies, Streamflow data, Water quality, Water velocity.

Streambed bioflims often determine the rate at which biodegradable materials are removed from the water column of shallow rock-lined streams. It was found that long term changes in water velocity affected the amount of biofilm biomass associated with a sand-free cobble streambed. Streambed biofilms were grown and acclimated to several different water velocities in an artificial stream. The rate at which each acclimated biofilm removed substrate from the water column was assessed by performing well-controlled, batch biodegradation tests. Substrate removal rates for each tested acclimation velocity were corrected for mass transport effects. Any differences in the mass-transport-corrected removal rates for the acclimated biofilms were due to variations in streambed biofilm biomass. Experimental results indicated that higher streambed biofilm biomass levels were found at the faster acclimation velocities. Such results imply that the rate of biodegradable contaminant removal in shallow biofilm-dominated streams is a function of the present water velocity (determines mass transport regime) and historical water velocities (determines streambed biofilm biomass levels). (Author's abstract)
W91-06859

EFFECTS OF SOIL PROPERTIES AND MOISTURE ON SORPTION OF TRICHLOROETHYLENE VAPOR.
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
S. K. Ong, and L. W. Lion.
Water Research WATRAG, Vol. 25, No. 1, p 29-36, January, 1991. 5 fig, 5 tab, 40 ref.

Descriptors: *Path of pollutants, *Soil contamination, *Soil properties, *Sorption, *Trichloroethylene, Adsorption, Analytical methods, Clay loam, Clay soils, Organic carbon, Sand, Soil water, Vapor transport.

The sorption of pollutants onto soils in the subsurface is an important abiotic process that determines pollutant fate and transport. The extent of pollutant sorption is influenced by physical and chemical composition of the sorbent, such as mineral type and the organic content. Correlation of trichloroethylene (TCE) vapor partition coefficients onto seven sorbents with selected properties showed

that: (1) under oven-dried conditions, specific surface area best described sorption of TCE and (2) under air-dried conditions (68% relative humidity), at field capacity and for saturated conditions, organic carbon content controlled sorption. The change in the dependency of TCE vapor partition coefficients, from specific surface area at oven-dried conditions to organic carbon content at air - dried conditions, is hypothesized to result from: (1) reduced sorption of TCE onto mineral surfaces because of competition with water and (2) increased importance of partitioning into organic matter. At field capacity, the sorption of TCE vapor can be accounted for by two contributions: (1) dissolution of TCE in the water bound to the sorbent as governed by Henry's law and (2) sorption of TCE at the solid-liquid interface as governed by a saturated partition coefficient. Dissolution of TCE into surface-bound water can constitute a large fraction of the total TCE uptake from the vapor phase for sorbents with low organic carbon content. (Author's abstract)
W91-06861

MICROBIAL QUALITY AND PERSISTENCE OF ENTERIC PATHOGENS IN GRAYWATER FROM VARIOUS HOUSEHOLD SOURCES.
University of South Florida, Tampa. Coll. of Public Health.
For primary bibliographic entry see Field 3C.
W91-06862

TRACING THE INFLUX OF SEWAGE FROM A LEAKY SEWER INTO A VERY THIN AND FAST-FLOWING AQUIFER.
Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wasserguetewirtschaft und Gesundheitsingenieurwesen.
S. Rettinger, D. Ronen, A. J. Amiel, M. Magaritz, and W. Bischofsberger.
Water Research WATRAG, Vol. 25, No. 1, p 75-82, January, 1991. 8 fig, 4 tab, 18 ref.

Descriptors: *Aquifers, *Groundwater pollution, *Path of pollutants, *Samplers, *Sampling, *Sewage, Bicarbonates, Dialysis, Dissolved organic carbon, Leaching, Nitrates, Sulfates, Well seepage.

Groundwater samples obtained by a pump or a sampler lowered into a well are known to provide mixed water samples that do not reflect the vertical distribution of the chemical components. Therefore, the results obtained from monitoring groundwater quality with a multilayer sampler and a conventional groundwater pump were compared. Water parcels of different chemical composition were detected in a 1 m thick and up to 17 m/d fast-flowing groundwater system using a multilayer sampler (MLS) based on the dialysis cell technique. The parcels result from the infiltration of sewage effluents and also probably due to the leaching of sewage sludge from the agricultural land surface. Samples obtained at depth intervals as small as 3 cm in a natural gradient flow field revealed relatively high concentrations and variable profiles of Na (+), NO3 (-), HCO3 (-), SO4 (--), and DOC 9 m downstream of the infiltration pipe. A pump used to obtain water samples during a 2 year period, in the same research field, proved to be an inadequate sampling technique to trace the movement of sewage effluent. This is probably due the production of mixed water samples from different horizons of the aquifer. In clear contrast with the pump sample data, chemical profiles obtained with the MLS suggested the presence of a pollution source upstream from one the six sampling wells. (Doyle-PTT)
W91-06867

CHANGE IN C:N:P RATIOS DURING PASSAGE OF WATER AREAS FROM RIVERS TO A LAKE.
National Inst. for Environmental Studies, Tsukuba (Japan). Water and Soil Environment Div.
S. Ebise, and T. Inoue.
Water Research WATRAG, Vol. 25, No. 1, p 95-100, January, 1991. 3 fig, 8 tab, 9 ref.

Descriptors: *Eutrophic lakes, *Eutrophication, *Influent streams, *Japan, *Path of pollutants, *Pollution load, Biological oxygen demand, Carbon, Chemical oxygen demand, Lake Kasunigaura, Lakes, Nitrogen, Nutrient concentrations, Phosphorus, River discharge, Total organic carbon.

Many closed water areas in Japan are subject to serious eutrophication. Weekly observations of the carbon load of four rivers flowing into Lake Kasumigaura were conducted during a 1 year period. A remarkable statistical characteristic for input loads of carbon (TOC), nitrogen (T-N),and phosphorus (T-P), from the four river basins, was their dependence on discharge. Since stormy days had high discharges and high concentrations of particulate matter, their nutrient loads became larger that those on dry days. Loads of the three elements in the inflow rivers to Lake Kasumigaura were measured seasonally for one year. The TOC:T-N:T-P ratios for the whole of the lake and for a bay receiving inflow from three rivers were estimated to be 27-45:8-32:1 on the basis of monthly observations. The various statistical characteristics of inflow loads from the river basin of different types of land use, indicated that the TOC:T-N:T-P ratios in an urban river are higher than those in a rural river. Most of the inflow loads of particulate nutrients were deposited in the river mouth, whereas the inflow loads of dissolved nutrients and production-degradation processes of organic matter largely controlled the nutrient budget in the lake water as shown by a comparison of the ratios for surface mud, phytoplankton and detritus. (Doyle-PTT)
W91-06870

AMBIENT CONCENTRATIONS, SCAVENGING RATIOS, AND SOURCE REGIONS OF ACID RELATED COMPOUNDS AND TRACE METALS DURING WINTER IN NORTHERN MICHIGAN.
General Motors Research Labs., Warren, MI. Environmental Science Dept.
S. H. Cadle, R. VandeKopple, P. A. Mulawa, and J. M. Dasch.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 2981-2989, 1990. 3 fig, 5 tab, 27 ref.

Descriptors: *Acid rain, *Chemistry of precipitation, *Michigan, *Precipitation scavenging, *Snow, *Trace metals, *Water pollution sources, Air masses, Anions, Chemical analysis, Nitrates, Nitric acid, Snowpack, Sulfates, Sulfur dioxide, Water analysis.

Daily measurements of the atmospheric concentrations of HNO3, NO3(-), NO2, SO2, SO4(2-), NH4(+), and several trace metals were made in Michigan over a 124-day period during the 1984-1985 winter. The composition of the daily precipitation was also determined. The relative contributions of scavenged NO3(-) and HNO3 to the precipitation was estimated by assuming that the NO3(-) scavenging ratio was the same as that of trace metals with a similar particle size. Similarly, the SO4(2-) and SO2 contributions were based on the scavenging ratios of NH4(+) and trace metals. On this basis, it was determined that the event median NO3(-) and HNO3 scavenging ratios were 500 and 3,500, respectively. NHO3 scavenging accounted for 83% of the total scavenged NO3(-). Scavenging of SO4(2-) accounted for all the snow SO4(2-) in 67% of the events. In the remaining events, some SO2 was scavenged, with a median scavenging ratio of 219. Overall, 67% of the snowfall acidity appeared to be due to NHO3 scavenging. Backward air-mass trajectories that were calculated for each event were used to determine the general source regions of the acidic species. Snow associated with air masses from the south and west accounted for 81% and 75% of the deposited NO3(-) and SO4(2-), respectively. (Author's abstract)
W91-06875

TESTS OF MODELS OF CLOUDWATER DEPOSITION TO FOREST CANOPIES USING ARTIFICIAL AND LIVING COLLECTORS.
Tennessee Valley Authority, Muscle Shoals, AL. Atmospheric Science Dept.
For primary bibliographic entry see Field 2B.
W91-06876

COMPOSITION OF BULK PRECIPITATION ON A COASTAL ISLAND WITH AGRICULTURE COMPARED TO AN URBAN REGION.
Vrije Univ., Amsterdam (Netherlands). Dept. of Meteorology.
For primary bibliographic entry see Field 2B.
W91-06877

VERTICAL DISTRIBUTION OF AEROSOLS AND ACID RELATED COMPOUNDS IN AIR AND CLOUDWATER.
Atmospheric Environment Service, Toronto (Ontario).
G. A. Isaac, W. R. Leaitch, and J. W. Strapp.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 3033-3046, 1990. 9 fig, 4 tab, 26 ref.

Descriptors: *Acid rain, *Aerosols, *Chemistry of precipitation, *Cloud chemistry, *Cloud liquid water, *Path of pollutants, Air masses, Clouds, Mixing, New York, Nitrates, Nitrogen oxides, North Bay, Ontario, Sulfates, Syracuse, Vertical distribution.

Vertical profiles (surface to 5 km) of aerosol particle number concentrations, nitrogen oxide mixing ratio, and cloudwater sulfate and nitrate equivalent concentration were obtained in three studies: North Bay, Ontario during the summer of 1982 and the winter of 1983-1984, and Syracuse, New York during the fall of 1984. Generally, airborne concentrations are highest with air-mass back trajectories from the south and lowest with back trajectories from the north. For the southerly trajectories, median particle number concentrations (0.2-2 microns) near ground level (950 mb) vary from 1,700/cu cm during the summer project to 800/cu cm during the winter project. At 700 mb, the south trajectory particle number concentration ranged between 60 and 170/cu cm. Median nitrogen oxide mixing ratios for southerly back trajectories were approximately 6 and 9 ppb at 950 mb and 0.4 and 0.8 ppb at 700 mb for the fall and winter projects, respectively. Comparison of particle number concentration profiles outside of cloud with cloud droplet plus interstitial aerosol particle number concentrations inside cloud indicate that cumulus clouds can transport aerosols vertically from below cloud base. In contrast, stratiform clouds have similar concentrations inside the clouds as outside at the same altitude. (Author's abstract)
W91-06878

RELATIONSHIP BETWEEN PRECIPITATION AMOUNT AND WET DEPOSITION OF NITRATE AND AMMONIUM.
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
R. Prado-Fiedler.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 3061-3065, 1990. 4 fig, 25 ref.

Descriptors: *Acid rain, *Ammonium, *Chemistry of precipitation, *Nitrates, *Rainfall, *Wet deposition, Baltic Sea, Clouds, Conductivity, Ion exchange chromatography, Precipitation, Precipitation scavenging.

Precipitation collected as wetfall-only on a weekly basis at two sites in the Western Baltic was analyzed for nitrate and ammonium. Both concentration and wet deposition of nitrate and ammonium showed a highly significant correlation with precipitation amount. The relationship between concentration and precipitation amount is described by an inverse half-power law, while wet deposition of nitrate and ammonium is characterized by a dependence on the square root of precipitation amount. This relationship governing wet deposition is shown to be a consequence of the dependence of concentration on precipitation amount. (Author's abstract)
W91-06879

STABILITY OF THE PH AND THE CONTENTS OF AMMONIUM AND NITRATE IN PRECIPITATION SAMPLES.
Ustredni Ustav Geologicky, Prague (Czechoslovakia).
J. Vesely.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 3085-3089, 1990.

Descriptors: *Acid rain, *Ammonium, *Chemistry of precipitation, *Hydrogen ion concentration, *Nitrates, *Sample preservation, Acidification, Acidity, Aluminum, Iron, Precipitation scavenging, Seasonal variation, Silicon, Trace elements, Water analysis.

The changes in the pH and the contents of ammonium, nitrate, and 10 other components including trace elements were studied in precipitation samples for a period of up to 300 days. The concentration of free H(+) ions is affected after deposition by several processes, the most important being bioconsumption of NH4(+) leading to an increase in the H(+) ion level depending on the length of the sampling interval, the time of year, and the way of storing the samples prior to their analysis. It is proposed that, for the purpose of comparing the acidities of precipitation waters and their effects on acidification of the environment, the corrected H(+) ion concentration be calculated from the pH value and the concentrations of ammonium and nitrate. The corrected H(+) value depends little on the bioconsumption of ammonium and nitrate after deposition and thus is not very sensitive to the way of storing the samples, the sampling interval, and the time elapsed between deposition and the sample analysis. Dissolution of Fe, Al, Si, and some trace elements from the particles scavenged during precipitation was slow in the studied samples; it is advantageous to digest the sample in a microwave oven prior to determination of these elements. (Author's abstract)
W91-06880

SITE-SPECIFIC UNDERESTIMATION OF WETFALL NH4(+) USING NADP DATA.
Kansas State Univ., Manhattan. Div. of Biology.
For primary bibliographic entry see Field 2K.
W91-06881

DDT IN MYTILUS EDULIS: SPATIO-TEMPORAL VARIATIONS, IN THE PUNTA BANDA ESTUARY, BAJA CALIFORNIA, MEXICO.
Universidad Autonoma de Baja California, Mexicali (Mexico). Inst. de Investigaciones Oceanologicas.
M. S. Galindo-Bect, and B. P. Flores-Baez.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 179-184, February 1990. 2 fig, 2 tab, 15 ref.

Descriptors: *Bioaccumulation, *DDT, *Estuarine environment, *Mexico, *Path of pollutants, *Sea mussels, Bioavailability, Chlorinated hydrocarbon insecticides, DDE, Degradation products, Estuaries, Filtration, Insecticides, Lipids, Sediments, Spatial distribution, Temporal distribution, Tides.

Levels of DDT were studied in the mussel Mytilus edulis collected from three sites in the Punta bay Estuary, Baja California, in order to define the dynamics of this pollutant in the estuary. The presence of DDT and its metabolites was detected every month sampled, though more than 85% corresponded to DDE. The highest values of total DDT were always found at the head of the estuary except in August when it was found at the mouth of the estuary. The maximum value of total DDT found throughout the period was 58.11 ppb at the head of the estuary; the minimum was 10.82 at the middle of the estuary. Total DDT is related to the percentage of lipids; in all cases, a decrease in lipid content corresponds to a decrease in total DDT and vice versa. It should be noted that the organisms sampled are subject to completely different environmental conditions with regard to biological availability of the pollutant in the studied sites. Concentrations of DDT were two orders of magnitude below the tolerance limit for human consumption (5ppm). (Doria-PTT)
W91-06883

HIGH CADMIUM RESIDUES OBSERVED DURING A PILOT STUDY IN SHOREBIRDS AND THEIR PREY DOWNSTREAM FROM THE EL SALVADOR COPPER MINE, CHILE.
Institute of Ocean Sciences, Sidney (British Columbia).
K. Vermeer, and J. C. Castilla.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 242-248, February 1990. 2 fig, 2 tab, 9 ref.

Descriptors: *Bioaccumulation, *Cadmium, *Chile, *Food chains, *Marine life, *Mine wastes, *Mining effects, *Path of pollutants, *Water birds, Algae, Beaches, Copper, Crabs, Heavy metals, Invertebrates, Liver, Shores, Tissue analysis, Water pollution effects.

A pilot study of cadmium and copper residues from tailings from the El Salvador copper mine discharged near Chanaral, Chile was initiated in November 1981 and March 1982. Samples were taken from beach deposits, algae, marine invertebrates, shorebirds, and the prey from their stomachs. Copper and cadmium show a decreasing residue gradient in beach deposits from the discharge site north, although concentrations become elevated again at Puerto Pan de Azucar, where an ore processing plant operated up to 50 years ago. Cadmium residues were particularly elevated in gray gulls (Larus modestus--22.8 mg/kg), curlews (Numenius hudsonicus) from Puerto pan de Azucar (49.3 mg/kg), and whimbrels (N. phaeopus) collected from various locations (38 mg/kg). The high cadmium residues in livers of those birds may relate to their diet, consisting of Emerita analoga, which had elevated cadmium residues compared to other marine organisms. Since the highest cadmium residues in birds and marine organisms occurred at Puerto Pan de Azucar and a reference site 60 km south of Chanaral, most cadmium contamination does not appear to be related to the present tailing discharge from the El Salvador copper mine, but may relate to former handling of ore at those locations or to naturally occurring high background levels of cadmium. High cadmium residues occur mostly in birds feeding on intertidal marine organisms, rather than in fish. (Doria-PTT)
W91-06893

ACCUMULATION FACTORS FOR ELEVEN POLYCHLORINATED BIPHENYL CONGENERS.
Environmental Research Lab.-Narragansett, Newport, OR. Mark O. Hatfield Marine Science Center.
S. P. Ferraro, H. Lee, L. M. Smith, R. J. Ozretich, and D. T. Specht.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 276-283, February 1990. 4 tab, 15 ref.

Descriptors: *Bioaccumulation, *Path of pollutants, *Polychlorinated biphenyls, *Sediment contamination, Biological magnification, Chromatography, Clams, Gas chromatography, Lipids, Organic carbon, Sediment analysis, Sediments, Solubility, Statistical analysis, Tissue analysis, Water pollution.

Bioaccumulation tests were conducted with clams (Macoma nasuta) exposed to sediment collected from the Southern California Bight. Sediment and tissue samples were analyzed for 11 polychlorinated biphenyl (PCB) congeners. Mean accumulation factors (AF) were then calculated. Statistically significant differences between some treatment AF means were found for 6 congeners. The magnitude of the differences was small, however, the mean AFs differing by a factor of about 2-3 for a given congener. Mean AFs exceeded 2 for PCB-52 (2,2',5,5' tetrachlorobiphenyl in 2 treatments; all other mean AFs were <2. More than half (10 of 18) of the individual clam AFs that exceeded 2 were for PCB-52, and most (13 of 18) individual clam AFs >2 occurred in clams exposed to a sediment from one station having a low concentration of pollutant and low total organic carbon. Of the total number of AFs determined, only 18, or about 4%, exceeded 2. Mean AFs were not constant across the 11 PCB congeners in 3 of the 5 treatments. Accumulation factors appear to be related to the hydrophobicity (or lipophilicity) of the congeners since there were highly significant negative rank correlations between individual clam AFs and log of the octanol/water partition coefficient in each of the treatments. (Doria-PTT)
W91-06894

MOVEMENT OF BROMACIL AND HEXAZINONE IN A MUNICIPAL SITE.
New South Wales Dept. of Agriculture, Rydalmere (Australia). Biological and Chemical Research Inst.
W. J. Allender.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 284-291, February 1990. 1 fig, 2 tab, 14 ref.

Descriptors: *Bromacil, *Herbicides, *Hexazinone, *Path of pollutants, *Urban areas, Acidity, Australia, Calcium, Eucalyptus trees, Gas chromatography, Liquid chromatography, Magnesium, Organic matter, Phosphates, Ponding, Semiarid lands, Shrubs, Soil properties, Soil texture, Soil types, Trees, Vegetation, Xerophytes.

A town in New South Wales, Australia, was sampled in 1988 to determine the movement of herbicides away from target areas after it was noticed that native trees around the site were dying following an application. Soil samples from 7 sites were analyzed by liquid chromatography primarily for bromacil and hexazinone. Bromacil was detected at 5 sites while hexazinone was found at 4 sites. The detection of hexazinone was unexpected, as bromacil was said to have been the only herbicide used for weed control around buildings and pipeline valve sites for some years. The patterns of dead native flora at the site suggest some lateral movement of hexazinone. The die-back of trees and shrubs, especially Eucalyptus sp., was noticeable following heavy rainfall which resulted in surface water flow and water ponding. The study illustrates the consequences of applying a mobile herbicide that can move away from target areas to affect or destroy xerophytic native species. (Doria-PTT)
W91-06895

BIOLOGICAL SURVEY OF GROUND WATER FROM THE TEHRAN PLAIN, IRAN.
Tehran Univ. (Iran). School of Pharmacy.
For primary bibliographic entry see Field 2F.
W91-06901

HEAVY METALS AND ORGANIC MICROPOLLUTANTS IN FLOODPLAINS OF THE RIVER WAAL, A DISTRIBUTARY OF THE RIVER RHINE, 1958-1981.
Institute for Soil Fertility, Haren (Netherlands).
J. Japenga, K. H. Zschuppe, A. J. De Groot, and W. Salomons.
Netherlands Journal of Agricultural Science NETMAW, Vol. 38, No. 3A, p 381-397, 1990. 10 fig, 6 tab, 15 ref.

Descriptors: *Flood plains, *Heavy metals, *Path of pollutants, *River Waal, *Rivers, *Sediment contamination, *The Netherlands, Arsenic, Cadmium, Chromium, Copper, DDT, Hexachlorobenzene, Hydrodynamics, Lead, Mercury, Nickel, Polychlorinated biphenyls, Polycyclic aromatic hydrocarbons, River Rhine, Suspended solids, Zinc.

During periods of high water discharge, dyke-protected floodplains of the River Rhine in the Netherlands become inundated and suspended matter from the river settles out. In the last 30 years, floodplain top layers have been sampled several times just after deposition; samples were dried and stored in a specimen bank. These samples were used to assess the development of sediment contamination with heavy metals and organic micropollutants during the past decades. Heavy metals investigated include zinc, copper, chromium, lead, cadmium, nickel, mercury, and arsenic. Different groups of chemically persistent organic micropollutants were studied: polycyclic aromatic

hydrocarbons, polychlorinated biphenyls, hexachlorobenzene, DDT, and DDT metabolites. In general, the levels of most contaminants decreased substantially between 1958 and 1981. The variation among the different floodplain locations is due to differences in hydrodynamic characteristics of the location. A comparison was made between the concentrations found and the levels considered acceptable if the floodplain area is used for cattle grazing; a comparison was made also with estimated natural background levels and with reference values defined by the Dutch government. (Author's abstract)
W91-06936

DEVELOPMENT OF A TOXIC ALEXANDRIUM MINUTUM HALIM (DINOPHYCEAE) BLOOM IN THE HARBOUR OF SANT CARLES DE LA RAPITA (EBRO DELTA, NORTHWESTERN MEDITERRANEAN).
Instituto de Ciencias del Mar, Barcelona (Spain).
M. Delgado, M. Estrada, J. Camp, J. V. Fernandez, and M. Santmarti.
Scientia Marina, Vol. 54, No. 1, p 1-7, March 1990. 7 fig, 26 ref.

Descriptors: *Dinoflagellates, *Eutrophication, *Mediterranean Sea, *Path of pollutants, *Phytoplankton, *Red tide, *Toxicity, Bays, Mixing, Mussels, Nutrients, Shellfish, Stratification, Temperature effects, Water pollution sources, Weather.

A bloom of Alexandrium minutum, reaching concentrations up to 28 million cells/L, was observed in the harbor of San Carles de la Rapita (northwestern Mediterranean) on May 4, 1989. During the following days, paralyzing shellfish poisoning (PSP) toxicity was detected in mussels exposed to harbor waters and in mussels from a neighboring bay. Shellfish extraction was stopped in the delta region and no human illness occurred. Meteorological and hydrographic conditions during the red tide were typical of those reported for similar events elsewhere. Mixing by strong winds at the end of April may have caused nutrient enrichment. The following warm weather and stratification of the water column may have favored the accumulation of motile organisms such as dinoflagellates, that were finally dispersed by strong winds of May 23-25. The origin of A. minutum in the region is unknown. Further red tides are likely to occur in the region. The hydrologic conditions in the delta, with frequent fertilization events followed by periods of water column stratification, may be specially favorable for red tide development. Another point to consider is the possible effect of water eutrophication in increasing the frequency and intensity of phytoplankton blooms. Continuing research is necessary to improve our understanding of the red tide phenomenon and to devise adequate means to mitigate damage. (Author's abstract)
W91-06938

EL NINO EFFECTS ON HYDROGEN ION CONCENTRATION OF A CALIFORNIA RESERVOIR.
California Univ., Berkeley. Kearney Foundation of Soil Science.
J. G. McColl.
Biogeochemistry BIOGEP, Vol. 10, No. 1, p 29-36, 1990. 3 fig, 1 tab, 15 ref. University of California, Berkeley, California Hatch Project CA-B-PSB-3664-H.

Descriptors: *Acid rain, *California, *Climatology, *El Nino, *Hydrogen ion concentration, *Reservoirs, *Weather patterns, Chemistry of precipitation, Climates, Precipitation, Seasonal variation, Storm runoff, Storms.

The yearly and monthly variation in the hydrogen ion concentration of discharge water from Pardee, a large reservoir in the central Sierra Nevada of California, with the occurrence of El Nino events was examined. El Nino is part of a complex system of fluctuations referred to as El Nino/Southern Oscillation (ENSO) which is the dominant index of global climatic changes over time periods of months to a few years. ENSO anomalies generally result in unusual winter conditions mid-latitude regions, well as causing major changes in tropical rainfall patterns associated with severe drought conditions or torrential rainfall patterns in other parts of the globe. Data of untreated reservoir discharge water were obtained from weekly records of the Municipal Utilities District. Samples were collected at the outlet tower of the Pardee Reservoir. Hydrogen ion activity was calculated from potentiometric measurements made at the site immediately following collection. Monthly and yearly means were calculated, and regression analyses were performed using standard statistical methods. Hydrogen ion concentration of discharge water from Pardee reservoir was greater than expected in years of El Nino occurrence over the period 1954-86. This pattern is in addition to the general increase in H(+) concentration over the same period attributed to acidic atmospheric deposition. Monthly means of H(+) concentration also show differences between El Nino and non-El Nino years. Total annual runoff does not seem to be a controlling factor; the source and timing of storms are probably more important. Storms are usually from the west or northwest, but during El Nino years, tropical-like storms from a more southerly direction appear to carry acidic pollutants to the central Sierra Nevada. (Agostine-PTT)
W91-06943

METHANE PRODUCTION AND SULFATE REDUCTION IN TWO APPALACHIAN PEATLANDS.
Villanova Univ., PA. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W91-06946

CUMULATIVE EFFECT OF WETLANDS ON STREAM WATER QUALITY AND QUANTITY: A LANDSCAPE APPROACH.
Minnesota Univ.-Duluth. Natural Resources Research Inst.
For primary bibliographic entry see Field 2H.
W91-06947

TRANSPORT OF GROUNDWATER-BORNE NUTRIENTS FROM WATERSHEDS AND THEIR EFFECTS ON COASTAL WATERS.
Boston Univ., MA. Marine Biological Lab.
I. Valiela, J. Costa, K. Foreman, J. M. Teal, and B. Howes.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 177-197, 1990. 8 fig, 6 tab, 86 ref. NSF Grants BSR 84-18268 and BSR 85-20473.

Descriptors: *Anoxic conditions, *Coastal waters, *Eutrophication, *Groundwater movement, *Massachusetts, *Nutrient transport, *Nutrients, *Path of pollutants, Aquatic plants, Biogeochemistry, Chemical properties, Denitrification, Nitrogen compounds, Phosphates, Sediments, Watersheds.

It has become apparent during the last decade that groundwater flow and transport of nutrients into shallow coastal water are far more significant and widespread than had been realized. The flow of groundwater into Great Sippewissett Marsh, on the West coast of Cape Cod facing Buzzards Bay, was studied. The concentrations of nitrate, nitrite, ammonium and phosphate were measured. Concentrations varied widely, but the upper ranges of dissolved organic nitrogen and phosphate are two to three orders of magnitude higher than those of the receiving seawater. Anthropogenic activities on coastal watersheds increase nutrient concentrations of groundwater. As groundwater travels downslope it transports these nutrients toward the adjoining coastal water. The resulting nutrient loading rates can be significant because nutrient concentrations in coastal waters may be several orders of magnitude greater than those of receiving coastal waters. Groundwater-borne nutrients are subject to active biogeochemical transformations as they course through the upper 1 m or so of bottom sediment where conditions favor anaerobic processes such as denitrification, and other mechanisms that either sequester or release nutrients. The relative importance of advective vs. regenerative pathways of nutrient supply may result in widely different rates of release of nutrients from sediments. The relative activity of denitrifiers also may alter the ratio of N to P released to overlying waters, and hence affect which nutrient limits growth of producers. The consequences of nutrient loading include somewhat elevated nutrient concentrations in the watercolumn, increased growth of macroalgae and phytoplankton, reduction of seagrass beds, and reductions of the associated fauna. The decline in animals occurs because of habitat changes and because of the increased frequency of anoxic events by the characteristically high respiration rates found in enriched waters. (Author's abstract)
W91-06950

RADIUM IN THE SUWANNEE RIVER AND ESTUARY: SPRING AND RIVER INPUT TO THE GULF OF MEXICO.
Florida State Univ., Tallahassee. Dept. of Oceanography.
W. C. Burnett, J. B. Cowart, and S. Deetae.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 237-255, 1990. 7 fig, 3 tab, 30 ref. Florida Department of Environmental Regulation Contract LR 48 and Florida Institute of Phosphate Research Contract FIPR 83-05-016.

Descriptors: *Biogeochemistry, *Estuaries, *Groundwater movement, *Gulf of Mexico, *Radium, *Rivers, *Saline-freshwater interfaces, *Water pollution sources, Chemical properties, Suspended solids, Water.

A study of radium was conducted in the Suwannee River and estuary, one of the most important rivers in Florida in terms of discharge and radium input into the Gulf of Mexico. Two years of monthly sampling were conducted at seven stations in the river and several sampling profiles in the estuary. The study included measurements of particulate as well as soluble radium, thus allowing an evaluation of the contribution of 'river-borne' and 'desorbed-radium'. Results have shown that groundwater discharge, via springs, is a very important source of radium both to the river and to offshore Gulf of Mexico waters. Dissolved radium is maintained within relatively narrow limits in the river by uptake into suspended particles. In the estuary, dissolved radium versus salinity profiles show distinctive non-conservative behavior with radium in significant excess of its linear mixing value at mid-salinities. Unlike the situation in many other estuaries, however, desorption of radium from particles cannot account for most of the observed excess. Thus, the anomalously high radium characteristic of much of the west Florida shelf apparently does not have a riverine source. Direct effusion of high-radium groundwater into these coastal waters is thought to be the major supplier of radium, and perhaps other elements as well. Therefore, uranium-series isotopes may be useful tracers of the influence of groundwater on the coastal ocean. (Agostine-PTT)
W91-06953

NUTRIENT COUPLINGS BETWEEN ON-SITE SEWAGE DISPOSAL SYSTEMS, GROUNDWATERS, AND NEARSHORE SURFACE WATERS OF THE FLORIDA KEYS.
Harbor Branch Oceanographic Institution, Inc., Fort Pierce, FL.
B. E. Lapointe, J. D. O'Connell, and G. S. Garrett.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 289-307, 1990. 7 fig, 1 tab, 40 ref. NSF Grant OCE-8515492.

Descriptors: *Florida Keys, *Groundwater movement, *Groundwater pollution, *Nearshore processes, *Nutrients, *Septic wastewater, *Wastewater pollution, Canals, Chemical properties, Groundwater recharge, Nitrogen compounds, Observation wells, Salinity, Septic tanks.

A one-year study was conducted to determine the effects of on-site sewage disposal systems (OSDS, septic tanks) on the nutrient relations of limestone groundwaters and nearshore waters of the Florida Keys. Monitor wells were installed on canal residences with OSDS and a control site in the Key Deer National Wildlife Refuge on Big Pine Key. Groundwater and surface water samples were collected monthly during 1987 and analyzed for con-

centrations of dissolved inorganic nitrogen (DIN), soluble reactive phosphate (SRP), temperature and salinity. Significant nutrient enrichment (up to 5000-fold) occurred in groundwaters contiguous to OSDS; DIN was enriched an average of 400-fold and SRP some 70-fold compared to control groundwaters. Ammonium was the dominant nitrogenous species, while concentrations of nitrate + nitrite were also highly enriched. Relative to DIN, concentrations of SRP were low in enriched groundwaters. N:P ratios of enriched groundwaters were > 100 and increased with increasing distance from the OSDS, suggesting significant, but incomplete, adsorption of SRP by subsurface flow through carbonate substrata. Nutrient concentrations of groundwaters varied seasonally and were approximately 2-fold higher during the winter compared to summer. In contrast, surface water nutrient values were 2-fold higher during the summer compared to winter. Direct measurements of subsurface groundwater flow rate indicated that tides and increased groundwater recharge enhanced flow some 2-fold and 6-fold respectively. The observed seasonal coupling of OSDS-derived nutrients from groundwaters to surface waters is maximum during summer because of seasonally maximum tides and increased hydraulic head during the summer wet season. The yearly average benthic flux of anthropogenic DIN into contiguous canal surface waters is 5-fold greater than the highest rate of benthic N-fixation measured in carbonate-rich tropical marine waters. (Author's abstract)
W91-06956

NITROGEN INPUTS TO A MARINE EMBAYMENT: THE IMPORTANCE OF GROUNDWATER.
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
A. E. Giblin, and A. G. Gaines.
Biogeochemistry BIOGEP, Vol. 10, No. 3, p 309-328, 1990. 6 fig, 5 tab, 30 ref. NOAA WHOI Sea Grant Program Grant NA80AA-D-00077 and NSF Grant OCE 86-15055.

Descriptors: *Coasts, *Groundwater pollution, *Massachusetts, *Nitrogen, *Path of pollutants, *Runoff, Denitrification, Estuaries, Freshwater, Groundwater movement, Hydrologic budget, Nitrogen compounds, Sediments, Septic tanks.

The importance of nitrogen inputs from groundwater and runoff in a small coastal marine cove on Cape Cod, MA were examined. Groundwater inputs were evaluated by three different methods: a water budget, assuming discharge equals recharge; direct measurements of discharge using bell jars; and a budget of water and salt at the mouth of the cove over several tidal cycles. The lowest estimates were obtained by using a water budget and the highest estimates were obtained using a budget of water and salt at the cove mouth. Overall there was more than a five fold difference in the freshwater inputs calculated by using these methods. Nitrogen in groundwater appears to be largely derived from on site septic systems. Average nitrate concentrations were highest in the region where building density was greatest. Nitrate in groundwater appeared to behave conservatively in sandy sediments where groundwater flow rates were high, indicating that denitrification was not substantially reducing external nitrogen loading into the cove. Nitrogen inputs from groundwater were approximately 300 millimole-N/cubic meter/year of cove water. Road runoff contributed an additional 60 millimole/cubic meter/year. Total nitrogen inputs from groundwater and road runoff to this cove were similar in magnitude to river dominated estuaries in urbanized areas in other parts of the United States. (Author's abstract)
W91-06957

FATE OF ETHYLENETHIOUREA IN HAWAIIAN SOIL AND WATER.
Hawaii Univ., Honolulu. Dept. of Agricultural Biochemistry.
C. J. Miles, and D. R. Doerge.
Journal of Agricultural and Food Chemistry JAFCAU, Vol. 39, No. 1, p 214-217, January 1991. 1 fig, 3 tab, 20 ref. USDA Grants 88WRPIAP-17 and 85-CSRS-2-2570.

Descriptors: *Carbamates, *Ethylenethiourea, *Fate of pollutants, *Hawaii, *Path of pollutants, *Pesticides, *Soil contamination, Basalts, Chromatography, Clays, Computer models, Degradation products, Groundwater pollution, Radioactive tracers, Saturation zone, Soils, Toxicity.

Ethylenethiourea (ETU) degradation rates and products in soil and groundwater were determined by using standard and isotopically labelled ETU (C-13, C-14 and N-15). Although the ethylenebis(dithiocarbamate) (EBDC) fungicides show low toxicity, ethylenethiourea, which is a formulation byproduct and environmental metabolite, is goitrogenic and carcinogenic in laboratory animals. The occurrence of ETU in groundwater underscores the importance of its residue determination and environmental fate. Concentrations of ETU and ethyleneurea (EU) in groundwater and soil/water mixtures were determined by liquid chromatography (LC) using a silica column with 100% water as mobile phase. ETU sorption and degradation were tested in three Hawaiian soils with various physical and chemical compositions. Soils were flooded to simulate conditions in the soil saturated zone. Degradation and sorption were evaluated by a computer program, CXTFIT, that solves a convection/dispersion equation assuming linear adsorption and first order decay. The investigation shows that ETU is rapidly degraded and detoxified to EU and sulfate in soils studied by a chemical oxidation mechanism, possibly by ferric ion mediated soil surface generated hydroxyl radicals. EU is further degraded by microbes to ethylenediamine and CO2. ETU degraded very slowly in groundwater, but the rate increased significantly with addition of basalt. Although ETU is only weakly sorbed by soils and clays, it should not reach deep groundwater because of rapid breakdown in overlying soils. These results suggest a low potential for groundwater contamination by ETU. (Agostine-PTT)
W91-06959

ANALYSIS OF SULFUR IN SOIL, PLANT AND SEDIMENT MATERIALS: SAMPLE HANDLING AND USE OF AN AUTOMATED ANALYZER.
Illinois Univ., Urbana. Dept. of Forestry.
For primary bibliographic entry see Field 5A.
W91-06960

ENRICHMENT PROCESS OF 2,4-D DEGRADERS IN DIFFERENT SOILS UNDER UPLAND CONDITIONS.
Nagoya Univ. (Japan). Lab. of Soil Science.
N. Miwa, and S. Kuwatsuka.
Soil Science and Plant Nutrition, Vol. 36, No. 2, p 261-266, 1990. 5 fig, 13 ref.

Descriptors: *Biodegradation, *Chlorinated hydrocarbon insecticides, *Degradation products, *Enrichment, *Fate of pollutants, *Phenoxy acid herbicides, *Soil types, Agricultural chemicals, Pesticide residues, Sample preservation, Soil analysis, Soil contamination, Soil samples.

The enrichment process of 2,4-dichlorophenoxyacetic acid (2,4-D) degraders in soil under upland conditions was investigated using samples of a mineral soil and an Ando soil which were stored or not stored. A remarkably higher population of 2,4-D degraders in soils was found when the enumeration was performed using a mineral medium compared with the nutrient broth medium in the most probable number (MPN) method. The population and proliferation rate were proportional to the degradation rate of 2,4-D in the soils examined. 2,4-D was degraded after a longer lag period in the mineral soil after long-term storage than in the fresh soil, but the duration of storage did not affect the degradation rate of 2,4-D after the lag period. Since the population of the 2,4-D decreased through long term soil storage, a longer lag period was required for the proliferation of the degraders to cause an appreciable degradation of 2,4-D in the soil. Storage of the Ando soils did not affect the population size of the degraders and the degradation rate of 2,4-D in the soil. In the mineral soil, a higher concentration of 2,4-D resulted in a longer lag period for 2,4-D degradation, and 100 ppm of 2,4-D suppressed the proliferation of the degraders. These results indicate that the duration of the lag period for 2,4-D degradation in soil depended on the population size of 2,4-D degraders before the application and on the concentration of 2,4-D. (Author's abstract)
W91-06973

CHARACTERIZATION OF ALACHLOR AND ATRAZINE DESORPTION FROM SOILS.
Agricultural Research Service, St. Paul, MN.
S. A. Clay, and W. C. Koskinen.
Weed Science WEESA6, Vol. 38, No. 1, p 74-80, 1990. 2 fig, 6 tab, 16 ref.

Descriptors: *Agricultural chemicals, *Alachlor, *Analytical methods, *Atrazine, *Desorption, *Herbicides, *Path of pollutants, *Phenylamide herbicides, *Triazine pesticides, Adsorption, Clay loam, Corn, Hysteresis, Isotherms, Loam, Separation techniques, Soil contamination, Soil types, Soils, Soybeans.

Herbicide desorption isotherms may be affected by the amount of nondesorbable herbicide present in the soil. Alachlor and atrazine desorption in soils was studied to determine: (a) if a portion of adsorbed atrazine and alachlor was nondesorbable from two Minnesota soils used extensively for corn (Zea mays L.) and soybeans (Glycine max (L.) Merr.) production, and (b) the effects of correcting for the amount of nondesorbable herbicide on the desorption isotherms. Nondesorbable alachlor (as determined after methanol extraction) generally increased on a Waukegan silt loam (Typic Hapludolls) and a Ves clay loam (Udic Haplustolls) during five 0.01 M CaCl2 desorptions. Atrazine was totally extracted with methanol from the Waukegan soil after one desorption using 0.01 M CaCl2. However, after five desorptions with 0.01 M CaCl2 an average of 5.5 and 15.5% of the total recovered atrazine from two atrazine application rates was methanol nondesorbable from the Waukegan and Ves soils, respectively. Freundlich desorption isotherms adjusted for nondesorbable herbicide accounted for as much as 71% of the difference between adsorption and desorption isotherms. Only a portion of the hysteresis observed can be attributable to nondesorbable herbicide or degradation products. The amount of nondesorbable herbicide and the amount of hysteresis accounted for were dependent on the soil type, herbicide applied, solvent used for extraction, and the number of equilibration periods. The amount of nondesorbable herbicides may increase as the aging process of the herbicide in the soil progresses over days, weeks, and months. However, the amount of nondesorbable herbicide may explain a portion of observed hysteresis during laboratory batch desorption experiments. (Agostine-PTT)
W91-06982

DISSIPATION OF NORFLURAZON AND OTHER PERSISTENT HERBICIDES IN SOIL.
Arkansas Univ., Fayetteville. Dept. of Agronomy.
C. W. Hubbs, and T. L. Lavy.
Weed Science WEESA6, Vol. 38, No. 1, p 81-88, 1990. 3 fig, 6 tab, 25 ref.

Descriptors: *Fate of pollutants, *Herbicides, *Norflurazon, *Pesticide residues, *Pesticides, *Phytotoxicity, *Soil contamination, Adsorption, Capillarity, Chromatography, Organic matter, Photolysis, Plant growth, Radioisotopes, Separation techniques, Soil columns, Toxicity, Tracers.

Norflurazon applied for weed control in cotton, as well as some other herbicides, sometimes persist in soil from one growing season to the next at levels phytotoxic to the following crop. Dissipation modes of norflurazon were characterized by using C-14 labelled herbicides for adsorption, mobility, photolysis, and volatility studies to aid in the prediction of conditions influencing herbicide carryover problems. A direct soil-counting technique modified for use in these studies yielded a norflurazon recovery as high as 83% of the applied radioactivity. Relative mobility of the herbicides on soil

thin-layer chromatography plates was fluometuron > or = atrazine > norflurazon. Norflurazon adsorption increased and mobility decreased as soil organic matter and clay content increased. Considerable upward movement of norflurazon and atrazine occurred in subirrigated columns containing herbicide-treated Hebert silt loam. Upward movement in excess of 5 cm occurred in 10 days and 8 weeks for atrazine and norflurazon, respectively. Photolysis and volatilization studies with atrazine and norflurazon revealed low volatilization but significant photolytic losses for norflurazon w hen herbicide-treated soil-coated slides were exposed to ultraviolet or sunlight. After 98 h atrazine volatilization was greater and photolysis in sunlight less than that observed for norflurazon. Laboratory studies showing upward movement of norflurazon and atrazine, in conjunction with dissipation losses occurring at the soil surface, suggested that losses of norflurazon and atrazine are facilitated by movement in capillary water referred to as the 'wick' effect. (Author's abstract)
W91-06983

ROTATION AND CONTINUOUS USE OF DIETHOLATE, FONOFOS, AND SC-0058 ON EPTC PERSISTENCE IN SOIL.
Nebraska Univ., Lincoln. Dept. of Agronomy.
B. W. Bean, F. W. Roeth, A. R. Martin, and R. G. Wilson.
Weed Science WEESA6, Vol. 38, No. 2, p 179-185, 1990. 7 tab, 16 ref.

Descriptors: *Agricultural chemicals, *Agricultural practices, *Fate of pollutants, *Organophosphorus pesticides, *Pesticide residues, *Pesticides, *Soil contamination, *Thiocarbamate pesticides, Biodegradation, Dietholate, Field tests, Fonofos, Nebraska, Pesticide extenders, S-ethyl dipropylthiocarbamate, Weeds.

The effectiveness of S-ethyl dipropylthiocarbamate (EPTC) extender usage in soils from two Nebraska locations was examined. The studies were designed to determine the effects of initial application, repeated use, and rotation of dietholate, fonofos, and SC-0058 applied with EPTC on weed control and rate of EPTC biodegradation. The biodegradation of dietholate and SC-0058 following repeat applications were also examined to determine if extender biodegradation could be a factor in enhanced EPTC degradation in EPTC + extender history soils. Field and laboratory studies were conducted to examine the influence of continuous use and rotation of extenders on EPTC persistence in soils from Clay Center and Scottsbluff, NE. Rotation of EPTC + dietholate and EPTC + fonofos in soils with three prior annual treatments of each combination did not improve weed control compared to continuous use. SC-0058 was generally effective in slowing EPTC biodegradation in soils previously treated with EPTC, EPTC + dietholate, EPTC + fonofos, or EPTC + SC-0058. Dietholate was effective in slowing EPTC biodegradation in soil previously treated with EPTC or EPTC + SC-0058. SC-0058 appeared to have an inhibitory influence on the initial development of soil-enhanced EPTC biodegradation. Any enhanced biodegradation of dietholate of SC-0058 that may occur after repeated use was not a factor in enhanced EPTC degradation in EPTC + extender history soils. SC-0058 appears to be an effective EPTC extender and in some cases may be superior to dietholate or fonofos. (Agostine-PTT)
W91-06984

INVOLVEMENT OF SOIL MICROORGANISMS IN THE ACCELERATED DEGRADATION OF DIPHENAMID.
Agricultural Research Organization, Bet-Dagan (Israel). Volcani Center.
E. Avidov, N. Aharonson, and J. Katan.
Weed Science WEESA6, Vol. 38, No. 2, p 186-193, 1990. 5 fig, 2 tab, 28 ref.

Descriptors: *Degradation, *Diphenamid, *Fate of pollutants, *Microbial degradation, *Microorganisms, *Pesticides, *Phenylamide herbicides, *Soil organisms, Bacteria, Bacterial physiology, Cultures, Degradation products, Metabolites, Radioisotopes, Soil fungi, Tracers.

The degradation of diphenamid in soil conditioned for accelerated degradation and nontreated control soil, and the involvement of soil microorganisms in these processes were investigated. Soil with accelerated degradation and mixed bacterial cultures originating from the same soil degraded diphenamid and its monodemethylated metabolite (diphen M-1) much faster than the control. The bidemethylated derivative (diphen M-2) was degraded much more slowly then diphenamid or diphen M-1. The abundance of fungi capable of degrading diphenamid was similar in the soils with and without accelerated degradation. Degradation of diphenamid by mixed bacterial cultures from a soil with accelerated degradation was much faster than by a culture from nontreated soil and was suppressed by the fungicides thiram and fentin acetate. These two fungicides, as well as the bactericide chloramphenicol, suppressed diphenamid degradation in mixed bacterial cultures. The antifungal cycloheximide and the actinomycete suppressor PCNB did not affect the degradation of diphenamid. Metabolism of C-14 labelled diphenamid in a soil with accelerated degradation and in mixed bacterial cultures originating from the same soil showed similarities with regard to evolution of C-14 labelled CO2 and production of certain metabolites, while the metabolism of diphenamid by Fusarium, which rapidly degrades diphenamid in cultures, was different with regard to the above parameters. This suggests that development of accelerated degradation in a soil involves a shift in population and/or in activity of microbial degraders in favor of bacteria. It appears that the accelerated degradation occurred by inducing oxidative reaction which involves dimethylation of diphenamid. (Author's abstract)
W91-06985

PERSISTENCE OF CARBAMOTHIOATE HERBICIDES IN SOILS PRETREATED WITH BUTYLATE.
Clemson Univ., SC. Dept. of Agronomy and Soils.
E. G. Lawrence, H. D. Skipper, D. T. Gooden, J. P. Zublena, and J. E. Struble.
Weed Science WEESA6, Vol. 38, No. 2, p 194-197, 1990. 1 fig, 3 tab, 20 ref.

Descriptors: *Agricultural chemicals, *Agricultural practices, *Butylate, *Carbamothioate herbicides, *Fate of pollutants, *Path of pollutants, *Pesticides, *Soils, Assay, Biodegradation, Carbamate pesticides, Degradation products, Pesticide residues, Radioisotopes, Soil contamination, Soil organisms, Tracers.

Field and laboratory studies in the southeastern United States were conducted to: (a) examine the performance of butylate in butylate history soils and nonhistory soils; (b) determine if soil organisms adapted to utilizing butylate were cross-adapted to S-ethyl dipropylthiocarbamate (EPTC), vernolate, pebulate, or cycloate; and (c) determine persistence of these herbicides in carbamothioate history fields. Bioassays were used to demonstrate reductions of butylate and EPTC activity in four soils preconditioned by annual butylate applications. Combining these herbicides with dietholate, an enzyme inhibitor, prolonged persistence and restored normal herbicidal activity. Expected herbicidal efficacy occurred in adjacent plots with no history of carbamothioate use. Prior applications of butylate resulted in cross-adapted degradation of EPTC but not vernolate, pebulate, of cycloate. When samples of Cecil soil were treated in the laboratory with C-14 labelled butylate, evolution of C-14 labelled CO2 was significantly higher from soils that had received repeated field applications of butylate. Results indicated that growers in southeastern United States may experience problems with enhanced biodegradation of butylate where it is used continuously. In addition, problems with reduced EPTC persistence can readily occur in soils where there are problems with butylate. Duplicating tests on nonhistory soil enabled the determination that normal herbicidal activity was due to enhanced biodegradation from prior use of butylate and not to environmental of factors associated with application. It was shown that C-14 labelled herbicides could be used to predict problem soils and potential herbicide failure. (Agostine-PTT)
W91-06986

BIODEGRADATION OF BUTYLATE, EPTC, AND EXTENDERS IN PREVIOUSLY TREATED SOILS.
Wisconsin Univ.-Madison. Dept. of Agronomy.
R. G. Harvey.
Weed Science WEESA6, Vol. 38, No. 3, p 237-242, 1990. 6 tab, 10 ref.

Descriptors: *Agricultural chemicals, *Agricultural practices, *Biodegradation, *Butylate, *Carbamate pesticides, *Fate of pollutants, *Pesticide extenders, *Pesticides, *S-ethyl dipropylthiocarbamate, Corn, Crop yield, Field tests, Soil analysis, Weeds, Wisconsin.

To provide Wisconsin sweet corn producers with improved systems for controlling wild proso millet, two long-term field studies have been established. A 6-yr herbicide rotation study was designed to compare continuous versus alternate-year use of S-ethyl dipropylthiocarbamate (EPTC) and EPTC plus dietholate. A 5-yr study was designed to compare continuous applications of EPTC and butylate applied singly or with the extenders dietholate and SC-0058. Herbicide dissipation studies have been conducted annually with soil samples obtained from the field trials in order to quantify effects on herbicide biodegradation rates. Enhanced EPTC and butylate biodegradation occurred in soils previously treated with those herbicides. Enhanced biodegradation of dietholate occurred on soils previously treated with that extender plus either EPTC or butylate. Enhanced dietholate biodegradation was observed when applied alone or in combination with butylate or EPTC. Application with dietholate prevented enhanced biodegradation of butylate but not EPTC even though enhanced biodegradation of dietholate was occurring. Enhanced biodegradation of SC-0058 did not occur. SC-0058 prevented enhanced EPTC and butylate biodegradation even in soils previously treated for three consecutive years with the respective herbicide plus SC-0058. Application of either 1.1 or 2.2 kg/ha SC-0058 plus 6.7 kg/ha EPTC provided equal or better wild proso millet control and sweet corn yields than applications of EPTC alone or EPTC plus dietholate. The lack of apparent enhanced biodegradation of the extender SC-0058 combined with the consistently superior performance of EPTC plus SC-0058 combinations suggests a possible relationship between length of extender persistence and herbicide efficacy. (Agostine-PTT)
W91-06987

EFFECT OF MOISTURE ON CHLORIMURON DEGRADATION IN SOIL.
Du Pont de Nemours (E.I.) and Co., Wilmington, DE. Agricultural Products Dept.
T. P. Fuesler, and M. K. Hanafey.
Weed Science WEESA6, Vol. 38, No. 3, p 256-261, 1990. 5 fig, 2 tab, 18 ref.

Descriptors: *Chemical degradation, *Chlorimuron, *Degradation, *Drought effects, *Fate of pollutants, *Microbial degradation, *Pesticides, *Soil water, Degradation products, Hydrolysis, Loam, Radioisotopes, Silt, Soybeans, Sulfonylurea herbicides, Tracers, Weeds.

The drought conditions experienced in many crop production areas in the midwestern United States in 1988 raised questions concerning the effect of hot, dry conditions on herbicide degradation in soil. The effect of temperature and moisture on chlorimuron, a sulfonylurea herbicide used for broadleaf weed control in soybeans, degradation in soil was investigated. Surface soil (0 to 15 cm) collected from agricultural fields in Missouri (Colo loam) and Wisconsin (Rotamer silt loam) was used for the study. The overall degradation of chlorimuron was very similar at -0.1 and -1.5 MPa and slightly less in air-dry soil. Degradation rates increased with increasing temperature. The primary C-14 labelled compounds observed in moist-soil extracts were desmethyl chlorimuron and saccharin, while the primary C-14 labelled compound observed in air-dry soil extracts was saccharin. Saccharin is formed quantitatively from ethyl 2-(aminosulfonyl)-benzoate (phenylsulfonamide) during extraction and therefore represents phenyl-

sulfonamide formed in the soil as a result of chemical hydrolysis of the sulfonylurea bridge. These degradation products suggest that chemical hydrolysis of the sulfonylurea bridge is the primary mode of degradation in air-dry soil, while microbial degradation and chemical hydrolysis both occur in moist soil. The results indicate that drought conditions will have little net effect on chlorimuron soil degradation because even in air-dry soil there is enough moisture to effect chemical hydrolysis. Chemical hydrolysis will continue and the increased temperatures typical of a drought and decreased pH of dried soil will accelerate this process, offsetting the decrease in microbial degradation. (Agostine-PTT)
W91-06988

ADSORPTION AND DESORPTION OF ATRAZINE, HYDROXYATRAZINE, AND S-GLUTATHIONE ATRAZINE ON TWO SOILS.
South Dakota State Univ., Brookings. Dept. of Plant Science.
S. A. Clay, and W. C. Koskinen.
Weed Science WEESA6, Vol. 38, No. 3, p 262-266, 1990. 2 fig, 3 tab, 26 ref.

Descriptors: *Adsorption, *Adsorption kinetics, *Atrazine, *Desorption, *Hydroxyatrazine, *Path of pollutants, *Pesticides, *S-glutathione atrazine, *Triazine herbicides, Hydrogen ion concentration, Leaching, Loam, Silt, Soil chemistry, Soil solution, Soils.

Adsorption and desorption isotherms for atrazine and two metabolites, hydroxyatrazine (HA) and S-glutathione atrazine (GSHA), were determined by batch equilibration on Plano and Waukegan silt loam soils at two soil pH levels (Plano, 6.1 and 4.5; Waukegan 6.1 and 4.0). Freundlich adsorption isotherms were not affected by soil type except for GSHA at pH 4.0 to 4.5. When averaged over both soils, the order of adsorption at pH 6.1 was atrazine (Kf=3.7) < GSHA (Kf=7.3) << HA (Kf=25) and at pH 4.0-4.5 was atrazine (Kf=6.1) << HA (Kf=58) < or = GSHA (Kf: Plano = 35; Waukegan = 78). The average slope of the adsorption isotherms was 0.81. The slopes of all desorption isotherms were less than their respective adsorption isotherm slopes, indicating hysteresis. Atrazine desorbed into soil solution. With the exception of GSHA which desorbed from the pH 6.1 Plano silt loam, desorption of HA and from other treatments was negligible. In summary, two atrazine metabolites, HA and GSHA, were adsorbed to two silt loam soils to a greater extent than the parent atrazine. Adsorption of all three chemicals was pH dependent with higher adsorption on the low than the high pH soil. Atrazine was desorbed into soil solution over a 3-day period; however, HA and GSHA were not desorbed from the soil in most cases. These data indicate that once these metabolites are adsorbed, desorption will be very slow. The strong adsorption and low desorption characteristics indicate that HA and GSHA are not likely to leach in the soil profile. (Agostine-PTT)
W91-06989

OCTANOL/WATER PARTITION COEFFICIENT OF METHYLMERCURIC CHLORIDE AND METHYLMERCURIC HYDROXIDE IN PURE WATER AND SALT SOLUTIONS.
Army Biomedical Research and Development Lab., Fort Detrick, MD.
M. A. Major, D. H. Rosenblatt, and K. A. Bostian.
Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 5-8, 1991. 3 fig, 11 ref.

Descriptors: *Bioaccumulation, *Chlorides, *Mercury, *Methylmercury, *Path of pollutants, Absorption, Hydrogen ion concentration, Ionic strength, Partitioning, Saline water, Sodium chloride.

The 1-octanol/water partition coefficient (Kow) of methylmercury was determined at pH 7 in water and in aqueous solutions ranging from 0.0003 to 0.6000 M in sodium chloride. It was also determined over a pH range of 2 to 10 with a fixed sodium chloride concentration of 0.0045 M. In these experiments, Kow was seen to increase with increasing chloride concentrations in the range 0.0 to 0.075 M and to decrease with increasing pH above 7. Results were similar whether low levels of methylmercuric chloride or methylmercuric hydroxide were used as the starting materials. Partitioning was not affected by changes in ionic strength. The salinities chosen in this study approximate the range of chloride concentrations encountered in natural ecosystems. The difference between the Kow values for methylmercuric ion in pure water and in strong chloride solutions was +1.6 + or -0.2. A difference of this magnitude should have some effect on bioconcentration. The absorption of methylmercury compounds by aquatic organisms should be enhanced by increased salinity and by decreased pH. (Geiger-PTT)
W91-06991

DIRECT IN SITU SENSING OF THE FUGACITY OF HYDROPHOBIC CHEMICALS IN NATURAL WATERS.
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. W. Sproule, W. Y. Shiu, D. Mackay, W. H. Schroeder, and R. W. Russell.
Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 9-20, 1991. 4 fig, 1 tab, 22 ref.

Descriptors: *Air-water interfaces, *Dissolved solids, *Mercury, *Path of pollutants, *Volatility, Aromatic compounds, Chlorinated aromatic compounds, Fate of pollutants, Ontario, Organic compounds, Theoretical analysis, Toluene, Vapor pressure.

Two sparging devices have been designed, built, and tested to estimate the concentration of truly dissolved chemicals in water and thus the potential for diffusive transfer by volatilization. The first system is a floating sparger in which air is introduced into a chamber floating in the water body. In the second system, water is pumped continuously to the device located in a vessel or on shore, then the water is returned to the water body. Samples of air, and air contacted to achieve equilibrium with the water, are analyzed to give an unequivocal determination of the displacement of equilibrium between air and water. Essentially, the chemical's fugacity or partial pressure is measured. A steady state mass balance of the sparging principal was theorized. Exploratory test results in a wind-wave tank measured the concentrations of chlorobenzene and toluene in air and water. In the field, the level of mercury in the Wabigoon River system in northwest Ontario was calculated using the sparging technique to measure the volatilization of mercury. Laboratory tests with the continuous flow sparger showed that for all chemicals tested (1,4-dichlorobenzene, pentachlorobenzene, hexachlorobenzene, and octachlorostyrene), the concentration in the exit water was not significantly lower than that of the entering water. (Geiger-PTT)
W91-06992

TOXICOKINETICS AND TOXICITY OF A MIXTURE OF SEDIMENT-ASSOCIATED POLYCYCLIC AROMATIC HYDROCARBONS TO THE AMPHIPOD DIPOREIA SP.
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W91-06993

EFFECTS OF DISSOLVED ORGANIC CARBON ON ACCUMULATION AND ACUTE TOXICITY OF FENVALERATE, DELTAMETHRIN AND CYHALOTHRIN TO DAPHNIA MAGNA (STRAUS).
National Water Research Inst., Burlington (Ontario). Rivers Research Branch.
For primary bibliographic entry see Field 5C.
W91-06999

TOXICITY TO AQUATIC ORGANISMS OF OFF-TARGET DEPOSITION OF ENDOSULFAN APPLIED BY AIRCRAFT.
Environmental Protection Service, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5C.
W91-07000

OXIDATIVE DEHYDROCHLORINATION OF HEPTACHLOR BY DAPHNIA MAGNA.
Illinois Univ. at Chicago Circle. Dept. of Biological Sciences.
M. Feroz, A. A. Podowski, and M. A. Q. Khan.
Pesticide Biochemistry and Physiology PCBPBS, Vol. 36, No. 2, p 101-105, February 1990. 3 fig, 2 tab, 20 ref.

Descriptors: *Biotransformation, *Chlorinated hydrocarbon insecticides, *Daphnia, *Fate of pollutants, *Heptachlor, *Metabolism, Chronic toxicity, Ketones, Lake Michigan, Population exposure, Radioactivity techniques, Separation techniques.

The metabolism of heptachlor by Daphnia magna was studied by exposing 500 daphnids to C14-labeled heptachlor in 1 liter of Lake Michigan water for 72 hr. Organic extracts from the water were pooled and subjected to solvent extraction and analysis by thin layer chromatography. The thin-layer chromatograms were exposed to X-ray films and the areas corresponding to radioactivity were scraped, extracted, and further analyzed. Results showed that heptachlor is metabolized by the freshwater microcrustacean to 1-hydroxychlordene, 1-ketochlordene, 1-hydroxy-2,3-epoxychlordene, and their glucosides, sulfates, and other conjugates. 1-Hydroxychlordene is converted to 1-ketochlordene, indicating that in vivo formation of 1-ketochlordene may proceed via oxidative dehydrochlorination of HC-Cl in heptachlor to CH-OH (1-hydroxychlordene) followed by oxidation of the latter to 1-ketochlordene. The ketone formation from heptachlor may not result via a chlorhydrin intermediate. (Geiger-PTT)
W91-07002

INFLUENCE OF SELENIUM, SALINITY, AND BORON ON SELENIUM UPTAKE IN WILD MUSTARD.
Agricultural Research Service, Fresno, CA. Water Management Research Lab.
G. S. Banuelos, D. W. Meek, and G. J. Hoffman.
Plant and Soil PLSOA2, Vol. 127, No. 2, p 201-206, 1990. 4 fig, 2 tab, 28 ref.

Descriptors: *Bioaccumulation, *Boron, *Path of pollutants, *Salinity, *Selenium, Agricultural runoff, Birds, Evaporation ponds, Food chains, Plants, Salt tolerance, Sulfates, Toxicity, Water pollution effects.

Elevated levels of selenium (Se), boron (B), and other toxicants in evaporation ponds used for disposal of agricultural drainage water may accumulate in the food chain and cause toxicity and/or reproductive problems in wildfowl using the water. Wild brown mustard (Brassica juncea) was shown in greenhouse water cultures to determine the effects of Se, salinity, and B in the root media on total Se concentrations in plant tissues. The experimental design was a three-way incomplete factorial with treatments consisting of four Se concentrations (0, 2, 6, and 15 mg Se/L as Na2SeO4), four B concentrations (0.1, 2, 6, and 15 mg B/L as boric acid) and four salt treatments (0.5, 3, 10, and 15 dS m as NaCl and CaCl in approximately 5:1 ratio by weight). After 40 days of growing in the respective water culture treatment, plants were harvested, separated into shoots and roots and analyzed for total tissue Se and B, and shoot sulfate (SO4) concentrations. The treatments significantly influenced yield and uptake of Se, B, and SO4 by wild mustard. Shoot and root dry weight yields were reduced by 30% and 21%, respectively. Selenium and SO4 tissue concentrations were positively related to solution Se, while the Se model was independent of solution B and salinity. Similarly, B concentrations were positively related to solution B, while the B model was independent of solution Se and salinity. Therefore mustard is reasonably salt tolerant and accumulates Se and B when grown in waters laden with Se and B. (Author's abstract)

W91-07007

ACCUMULATION AND METABOLISM OF 2,4,6-TRICHLOROPHENYL-4'-AMINOPHENYL ETHER BY CARP.

Shiga Prefectural Inst. of Public Health and Environmental Science, Otsu (Japan).
T. Tsuda, S. Aoki, M. Kohma, and H. Harada.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 1, p 17-21, 1990. 6 fig, 12 ref.

Descriptors: *Animal metabolism, *Bioaccumulation, *Carp, *Fish physiology, *Herbicides, *Path of pollutants, *Toxicology, *Water pollution effects, Acute toxicity, Kidneys, Liver, Metabolites, Muscle.

The accumulation of the herbicide 2,4,6-trichlorophenyl-4'-aminophenyl ether (CNP-amino) in carp over a 14 day exposure was investigated. CNP-amino in carp could be divided into free CNP-amino (CNP-amino(I)) and bound CNP-amino (CNP-amino(II)). The bioconcentration factors (BCF) of CNP-amino(I+II) in carp were 90 +/- 38 (mean +/-SD, n = 3) for muscle, 402 for liver, 501 for kidney and 5368 for gallbladder after 14 days exposure. The BCF values in all four tissues of carp reached plateau after 10 days. 2,4,6-Trichlorophenyl-4'-acetamide phenyl ether (CNP-acetamide) was detected as a metabolite of CNP-amino in muscle and viscera of the carp. The rate of CNP-amino metabolism was fairly rapid, as determined from the ratio of CNP-acetamide to CNP-amino(I+II), with signficant metabolism occurring within the first day of exposure. (Hoskin-PTT)
W91-07019

BIOCONCENTRATION AND EXCRETION OF DIAZINON, IBP, MALATHION AND FENITROTHION BY CARP.

Shiga Prefectural Inst. of Public Health and Environmental Science, Otsu (Japan).
T. Tsuda, S. Aoki, M. Kojima, and H. Harada.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 1, p 23-26, 1990. 4 fig, 2 tab, 8 ref.

Descriptors: *Animal metabolism, *Bioaccumulation, *Biological magnification, *Carp, *Excretion, *Fungicides, *Insecticides, *Path of pollutants, *Toxicology, *Water pollution effects, Acute toxicity, Diazinon, Kidneys, Liver, Malathion, Muscle, Pesticide kinetics.

The bioconcentration and excretion of the insecticides diazinon, malathion and fenitrothion, and the fungicide IBP (S-benzyl diisopropyl phosphorothiolate) were studied in the carp (Cyprinus carpio L.). The concentrations of these compounds in muscle and viscera of the carp reached plateaus in 12-48 hr exposure. The average values of bioconcentration factors (BCF) for diazinon were 20.9 in muscle, 60.0 in liver, 111.1 in kidney and 32.2 in gallbladder over the 168 hr exposure period. Similarly, those values were 4.3-26.7 for IBP, 2.7-17.3 for malathion, and 36.0-157.1 for fenitrothion. Excretion processes follow first-order kinetics for malathion and second-order kinetics for the other pesticides. The excretion rate constants of malathion (/hr) were 0.13 for muscle, 0.12 for liver, 0.08 for kidney and 0.06 for gallbladder. Those of diazinon, IBP and fenitrothion (g/ng/hr) were 0.002-0.024 for muscle, 0.001-0.020 for liver, 0.0004-0.004 for kidney and 0.002-0.023 for gallbladder, respectively. (Author's abstract)
W91-07020

COMPARISON OF THE ACCUMULATION, TISSUE DISTRIBUTION AND SECRETION OF CADMIUM IN DIFFERENT SPECIES OF FRESHWATER FISH.

University Coll., Cardiff (Wales). Dept. of Biochemistry.
C. G. Norey, M. W. Brown, A. Cryer, and J. Kay.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 1, p 181-184, 1990. 3 fig, 3 tab, 13 ref. National Environment Research Council grants GR/4970A and GR/6179A.

Descriptors: *Animal metabolism, *Bioaccumulation, *Cadmium, *Fish physiology, *Path of pollutants, *Tissue analysis, *Toxicology, *Water pollution effects, Acute toxicity, Gills, Heavy metals, Kidneys, Liver, Loach, Trace metals, Trout.

Rainbow trout and stone loach were exposed to cadmium in their aquarium water and the fractional retention coefficient for metal ((micrograms Cd/100 g body wt)/((micrograms Cd/L) x weeks)) was measured in both species under different conditions of water hardness. The significant differences that distinguish the Cd-sensitive (rainbow trout) from the Cd-tolerant species (stone loach) were maintained. Rainbow trout and stone loach were exposed to Cd in their aquarium water for a minimum of 63 days. Following their transfer into Cd-free water, elimination of the metal from both species of fish was monitored for up to 132 and 170 days, respectively, and found to be minimal. The distribution of Cd within the three major Cd-sequestering organs (liver, kidney and gills) of the rainbow trout and stone loach did not change significantly during the period of their maintenance in Cd-free water. A comparison of the tissue distribution of Cd in rainbow trout and stone loach during early stages of exposure to the metal to 3 micrograms/L in their aquarium water under identical conditions indicated that the gill was the primary organ of accumulation in rainbow trout, whereas liver and kidney together were more important in the stone loach. (Author's abstract)
W91-07021

ACTIVITIES OF POLLUTANT METABOLISING AND DETOXICATION SYSTEMS IN THE LIVER OF THE PLAICE, PLEURONECTES PLATESSA: SEX AND SEASONAL VARIATIONS IN NON-INDUCED FISH.

Unit of Aquatic Biochemistry, Stirling (Scotland).
S. George, P. Young, M. Leaver, and D. Clarke.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 1, p 185-192, 1990. 3 fig, 3 tab, 54 ref.

Descriptors: *Animal metabolism, *Biotransformation, *Detoxification, *Fate of pollutants, *Flounders, *Liver, *Water pollution effects, Bioassay, Bioindicators, Cytochromes, Enzymes, Immature growth stage, Seasonal variation, Steroids, Temperature effects.

The ability of immature plaice to perform a number of representative hepatic phase I and II biotransformations were examined. Activities attributable to cytochrome P-450 1A1 and phenol UDP-glucuronosyltransferase activity were markedly higher in plaice than other fish or rats. Glucuronidation of sex hormones and bilirubin, conjugation of ethacrynic acid with glutathione and the sulfation of phenols were very much lower in plaice than in rats, indicating that these are minor pathways in this fish. MFO activities in sexually mature female plaice were 20-25% of those in immature fish, whilst there were no significant differences in glutathione S-transferase (GST) or glutathione peroxidase activity. Seasonal variations in activities were determined for use in biomonitoring studies. With the exception of microsomal GST, all enzymes and the liver somatic index showed a marked seasonal variation, activities were lower in summer and showed a gradual rise in autumn and winter with a peak in spring. This pattern appeared to be the inverse of the environmental temperature, indicative of a possible temperature-dependent effect; however, there was not direct proportionality and photoperiod, feeding behavior, plasma corticosteroid and plasma glucose also show a similar cyclical variation. Cytochrome P-450 dependent ethoxyresorufin O-deethylase and cytosolic glutathione S-transferase activities in immature male fish showed a two-fold elevation over those in immature females during late winter and spring in the period when gonadal regression might be occurring and may be due to elevated 11-ketotestosterone levels. (Author's abstract)
W91-07022

SPREADING OF OIL SPILLED UNDER ICE.

Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering.
P. D. Yapa, and T. Chowdhury.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1468-1483, December 1990. 8 fig, 1 tab, 25 ref.

Descriptors: *Ice, *Ice-water interfaces, *Mathematical models, *Model studies, *Oil spills, *Oil-water interfaces, *Path of pollutants, Buoyancy, Cleanup, Environmental impact, Laboratory methods, Mathematical equations, Viscosity.

A new set of equations is presented to describe the process of oil spreading under ice in calm waters. These equations consider the gravity (buoyancy)-inertia phase, the gravity (buoyancy)-viscous phase, and the termination of spreading during the buoyancy-surface-tension phase. The derivation considers both the constant discharge mode and the constant volume mode. Therefore, a complete description of the spreading phenomena from the time of initial spill to the termination of spreading is presented. Laboratory experiments were conducted using both real ice covers in a cold room and artificial ice covers. The experiments included different ice-cover roughnesses from smooth to rough, oils of different viscosities, and a variety of discharge conditions. The experimental data show close agreement with the theory. These equations can be used during cleanup or environmental impact assessment to estimate the area of an oil slick with respect to time. (Author's abstract)
W91-07029

EFFECT OF BUOYANCY ON TRANSVERSE MIXING IN STREAMS.

Stevens Inst. of Tech., Hoboken, NJ. Dept. of Civil, Environmental and Coastal Engineering.
M. S. Bruno, M. Muntisov, and H. B. Fischer.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1484-1494, December 1990. 5 fig, 2 tab, 7 ref.

Descriptors: *Buoyancy, *Flumes, *Hydrodynamics, *Mixing, *Path of pollutants, *Plumes, *Saline-freshwater interfaces, *Streamflow, Dye releases, Fluorometry, Laboratory methods, Mathematical equations, Mathematical models, Stream discharge.

A dye tracer study was conducted in a large recirculating flume for the purpose of examining the influence of buoyancy on transverse mixing in streams. Using Rhodamine WT dye, the transverse spread of a freshwater discharge into a saline receiving stream was measured downstream from the release point. The discharge emanated from a circular pipe 2.54 cm in diameter, aligned parallel to the stream flow and located at mid-depth at the flume sidewall. Fluorometer samples were obtained throughout the cross section at downstream stations spaced 18-24 m apart. The transverse variance of the depth-averaged concentration distribution was determined at each station. Using a dimensionless parameter reflecting the ratio of the buoyancy input to the stream turbulent intensity, findings are presented as to when the effects of buoyancy must be included in the analysis of transverse mixing. These findings illustrate the potential for greatly enhanced transverse mixing in cases of buoyant discharges, with a good deal of variability depending on discharge and stream characteristics. (Author's abstract)
W91-07030

ESTIMATION OF SHALLOW GROUNDWATER QUALITY IN THE WESTERN AND SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA.

San Joaquin Valley Drainage Program, Sacramento, CA.
For primary bibliographic entry see Field 2F.
W91-07037

POLLUTANTS IN SOIL, PARTICULARLY HEAVY METALS AND HARMFUL ORGANIC SUBSTANCES, AFTER YEARLY USAGE OF MUNICIPAL WASTES (SCHADSTOFFE IM BODEN INSBESONDERE SCHWERMETALLE UND ORGANISCHE SCHADSTOFFE AUS

LANGJAHRIGER ANWENDUNG VON SIEDLUNGSABFALLEN).
Landwirtschaftliche Untersuchungs- und Forschungsanstalt, Speyer (Germany, F.R.).
W. Kampe, C. Zurcher, and H. Jobst.
Available from the National Technical Information Service, Springfield, VA 22161, as TIBA-8980478. Price codes: E07 in paper copy, A01 in microfiche. Report No. 87-033, A, 1986. 149p, 16 tab, 140 ref.

Descriptors: *Heavy metals, *Land disposal, *Municipal wastes, *Organic compounds, *Soil contamination, *Wastewater disposal, Agriculture, Chlorinated hydrocarbons, Hydrocarbons, Phthalates, Polychlorinated biphenyls, Sludge utilization, Terphenyls.

Soil and plant samples, from a combined project with six institutes using high sewage sludge dosages between 1959 and 1980, were analyzed for chlorinated hydrocarbons, polychlorinated biphenyls (peak pattern) and four polycyclic aromatic hydrocarbons. The soil samples were randomly analyzed for isomers of 4-nonylphenols, phthalates, polychlorinated napthalines and polychlorinated terphenyls. There was no enrichment of the chlorinated hydrocarbons and no transfer to the cultivated plants. The polychlorinated biphenyl contents in soil were on the average 5 to 17 times increased (maximum factor of 61). The averages ranged between 0.005 and 0.0049, with maximas between 0.001 and 0.34 mg/kg soil. A transfer to plants (wheat, clover, sugar beet leaves, potatoes) was not established. The range of the other substances extended generally to 0.003 mg/kg, with an extreme value of 3.0 mg/kg soil for diethylhexylphthalate. The results indicate, with a high degree of certainty, that in agriculture no critical situation arises as a consequence of sewage sludge usage. (Author's abstract)
W91-07040

TRAVELTIME AND REAERATION COEFFICIENTS FOR THE NORTH PLATTE RIVER, CASPER TO ORIN, WYOMING.
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W91-07042

TOWARD MORE REALISTIC MATERIAL MODELS FOR RELEASE AND DISPERSION OF HEAVY GASES.
Lawrence Livermore National Lab., CA.
H. C. Rodean.
Available from the National Technical Information Service, Springfield, VA 22161. Price codes: A03 in paper copy, A01 in microfiche. 39p, 13 fig, 3 tab, 44 ref, append. DOE Contract W-7405-Eng-48.

Descriptors: *Air pollution sources, *Chemical reactions, *Gases, *Hazardous wastes, *Mathematical models, *Model studies, *Path of pollutants, Air pollution, Chemical interactions, Chemical speciation, Nitrogen tetroxide, Uranium hexafluoride.

Two toxic materials with complex behavior, uranium hexafluoride (UF6) and nitrogen tetroxide (N2O4), are used to illustrate the modeling of phase change in combination with chemical reactions. The properties of these materials, their phase diagrams, the dissociation of N2O4 into NO2, and the reactions of UF6 and N2O4 with water are reviewed. The models presented for mixtures of UF6 and N2O4 with dry and moist air are based on thermodynamic equilibrium, the ideal gas law, temperature dependent saturation-vapor pressure equations, a temperature-dependent equilibrium constant for the N2O4=2NO2 reaction, and the reactions of UF6 and N2O4/NO2 with H2O. There is some uncertainty about the later reaction, but the available evidence gives support to the assumed product, the nitric acid-water azeotrope. The material model equations are written in terms of pressure ratios and dimensionless parameters. All the parameters are positive and all but two are restricted to values between zero and unity. These equations are used to construct equilibrium diagrams with temperature and the mass fraction of the material in the mixture as the coordinates. The properties of the mixtures are illustrated by curves for constant values of vapor mass fraction, extent of N2O4 dissociation, and extent of chemical reaction. There is much common structure among the models for UF6 and N2O4 mixed with dry and moist air. The more complex cases reduce to simpler cases when certain parameters or variables are equal to zero. The solution of heat balance equations for the release of superheated UF6 that is subsequently mixed with air are plotted for three cases: mixing with dry air, mixing with moist air but assuming no chemical reaction, and mixing with moist air with the UF6-H2O reaction. The densities of these mixtures relative to ambient air are plotted, and the only case with positive buoyancy is that with the UF6-H2O reaction. (Lantz-PTT)
W91-07048

SALINITY--AN OLD ENVIRONMENTAL PROBLEM.
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Water Resources.
For primary bibliographic entry see Field 3C.
W91-07049

SUPERFUND RECORD OF DECISION: UNITED SCRAP LEAD, OH.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
For primary bibliographic entry see Field 5G.
W91-07051

APPLICATIONS OF REMOTE SENSING TECHNIQUES FOR THE INVENTORY AND MONITORING OF ENVIRONMENTAL POLLUTION.
Geofax B.V., Oldenzaal (Netherlands).
For primary bibliographic entry see Field 7B.
W91-07052

EFFECTS OF HETEROGENEOUS POROUS GEOLOGY ON GROUNDWATER FLOW AND TRANSPORT MODELING IN MULTIAQUIFER SYSTEMS.
Savannah River Lab., Aiken, SC.
For primary bibliographic entry see Field 2F.
W91-07053

SUPERFUND RECORD OF DECISION: RINGWOOD MINES/LANDFILL, VA.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
For primary bibliographic entry see Field 5G.
W91-07054

SUPERFUND RECORD OF DECISION: UPJOHN MANUFACTURING COMPANY, PR.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
For primary bibliographic entry see Field 5G.
W91-07056

IDENTIFICATION OF SOURCES OF SEDIMENT TRANSPORT IN SMALL BASINS WITH SPECIAL REFERENCE TO PARTICULATE PHOSPHORUS.
Copenhagen Univ. (Denmark). Inst. of Geography.
For primary bibliographic entry see Field 2J.
W91-07084

UNCERTAINTIES IN DEFINING THE SUSPENDED SEDIMENT BUDGET FOR LARGE DRAINAGE BASINS.
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2J.
W91-07111

5C. Effects Of Pollution

CHEMICAL ASPECTS OF WATER QUALITY AND HEALTH.
For primary bibliographic entry see Field 5F.
W91-05976

CHLORINATED DRINKING WATER AND BLADDER CANCER: EFFECT OF MISCLASSIFICATION ON RISK ESTIMATES.
Iowa Univ., Oakdale. Dept. of Preventative Medicine and Environmental Health.
For primary bibliographic entry see Field 5F.
W91-05982

CADMIUM TOXICITY TO PHOTOSYNTHESIS AND ASSOCIATED ELECTRON TRANSPORT SYSTEM OF NOSTOC LINCKIA.
Banaras Hindu Univ., Varanasi (India). Centre for Advanced Study in Botany.
Y. Husaini, A. K. Singh, and L. C. Rai.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 146-150, January 1991. 2 tab, 12 ref.

Descriptors: *Algae, *Cadmium, *Cyanophyta, *Nostoc, *Photosynthesis, *Toxicity, *Water pollution effects, Adenosine triphosphate, Algal physiology, Carbon fixation, Electron transport, Hill reaction assay, Oxygen requirements, Photosystems, Polarographic method.

The sensitivities of photosystem I, photosystem II, and the redox coupling between the two photosystems of Nostoc linckia exposed to different concentrations of cadmium, an aquatic contaminant, were compared to determine the toxic site of action in cyanobacteria and algae. Hill reaction assays were carried out within three hours of membrane preparation by a polarographic method and expressed in terms of either evolution or consumption of oxygen. Carbon fixation and total adenosine triphosphate (ATP) content were also measured. The results indicated that cadmium inhibited the electron transport chain, carbon-14 uptake and ATP content in a concentration dependent manner. Reduction in ATP synthesis was responsible for inhibition of C-14 incorporation. Specifically, it was determined that photosystem II was the primary site of action of cadmium for photosynthetic electron transport and may be the primary site of action of cadmium in cyanobacteria and algae. (Medina-PTT)
W91-05988

BIOCONCENTRATION OF ENDOSULFAN IN DIFFERENT BODY TISSUES OF ESTUARINE ORGANISMS UNDER SUBLETHAL EXPOSURE.
Hiroshima Univ. (Japan). Faculty of Applied Biological Science.
N. Rajendran, and V. K. Venugopalan.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 151-158, January 1991. 2 tab, 12 ref.

Descriptors: *Animal tissues, *Biological magnification, *Clams, *Endosulfan, *Estuaries, *Fish, *Oysters, *Sublethal effects, *Toxicology, *Water pollution effects, Chlorinated hydrocarbon insecticides, Gas chromatography, Liquid chromatography, Pesticide toxicity, Tissue analysis.

The bioconcentration of endosulfan in different tissues of the fishes (Mugil cephalus and Mystus gulio), oyster (Crassostrea madrasensis) and clam (Katelysa opima) was determined based on the measured concentration of endosulfan in an experimental medium of continuous flow for 10 days. Tissue analysis was conducted using silica gel column chromatographic and gas chromatographic methods. The results showed that tissue concentration of endosulfan was directly proportional to the degree of exposure to this pesticide. However, there were differences in the accumulated levels of this compound in the test organisms which might be due to the differences in the exposed concentrations of endosulfan as they were calculated on the basis of their LC50 values. It could be inferred that the uptake of pesticide mainly depended upon the storage capacity of the different organs. The high concentration of this pesticide in different tissues

may be detrimental to the biological activities of the organisms. (Medina-PTT)
W91-05989

EFFECTS OF PHTHALATE ESTERS ON THE LOCOMOTOR ACTIVITY OF THE FRESHWATER AMPHIPOD GAMMARUS PULEX.
Swedish Environmental Research Inst., Stockholm.
A. Thuren, and P. Woin.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 159-166, January 1991. 4 fig, 1 tab, 25 ref.

Descriptors: *Amphipods, *Animal behavior, *Phthalates, *Sublethal effects, *Toxicity, *Toxicology, *Water pollution effects, Fish, Invertebrates, Locomotor activity, Macrobenthos, Plastics, Sediment-water interfaces, Waterfleas.

Phthalates are of environmental concern owing to their large-scale annual production and to their ubiquitous use as additives in the manufacture of plastics. Phthalates show low acute toxicity to fish and are selectively toxic to cladocerans. Among the phthalates, di-2-ethylhexyl phthalate (DEHP) and dibutylphthalte (DBP) are the most commonly used compounds. This study was made to determine their effect on the overall locomotor activity of Gammarus pulex and the impact of long term exposure on diel activity under aquarium conditions. Animal activity was recorded by an IR light tray-photocell-passage where the number of light-beam interruptions per hour was registered. There was no significant difference in overall locomotor activity between non-exposed animals and animals exposed to 100 mg DEHP/L or DBP/L. However, at 500 mg/L, these compounds decreased the overall locomotor activity of this organism. In many polluted areas, most of the phthalate material becomes incorporated into the sediment and since phthalates are partitioned into sediment from water, benthic invertebrates living at the sediment-water interface will be more heavily exposed than pelagic animals. Thus, the level of exposure to phthalates from contaminated sediments might be high enough to induce sublethal effects on macrobenthos, such as overall disturbances in locomotor activity. (Medina-PTT)
W91-05990

CHANGES IN POULTRY LITTER TOXICITY WITH SIMULATED ACID RAIN.
Maryland Univ. Eastern Shore, Princess Anne.
G. Gupta, and S. Krishnamurthy.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 1, p 167-172, January 1991. 1 fig, 3 tab, 12 ref.

Descriptors: *Acid rain effects, *Agricultural runoff, *Farm wastes, *Maryland, *Nutrient transport, *Poultry, *Toxicity, *Water pollution effects, Antibiotics, Bioassay, Biochemical oxygen demand, Chemical analysis, Chesapeake Bay, Fishkill, Heavy metals, Hormones, Hydrogen ion concentration, Microorganisms, Microtox assay, Rainfall-runoff relationships, Statistical analysis, Surface runoff.

The Eastern Shore of Maryland on the Delmarva Peninsula generates 9500 metric tons of poultry manure litter per day. Poultry litter contains nutrients, antibiotics, heavy metals, hormones and many microorganisms. With rainfall, surface water runoff reaches the Chesapeake Bay from this region. This leachate with its high organic and inorganic salt contents and high biochemical oxygen demand can severely disrupt the aquatic life and cause fish kills. An experiment was therefore conducted to study the effect of simulated acid rain (pH 3, 4 and 5) on the toxicity of poultry litter extracts. The bioluminescent organism Photobacterium phosphoreum was used as the bioassay organism (Microtox assay). Changes in pH, conductivity and redox values for the poultry litter extracts and their relationship with time were also analyzed. The toxicity of acid rain (pH 4 or 5) with poultry litter was always higher than the toxicity of acid rain alone, but the toxicity decreased as the time of extraction increased. Acid rain (pH 3) was more toxic than its mixture with litter (24-hr extract); this antagonistic behavior may result from the observed increase in phosphate with extraction time and acidity. (Medina-PTT)
W91-05991

TOXICITY OF LINDANE, ATRAZINE, AND DELTAMETHRIN TO EARLY LIFE STAGES OF ZEBRAFISH (BRACHYDANIO RERIO).
Mainz Univ. (Germany, F.R.). Dept. of Zoology.
G. Gorge, and R. Nagel.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 246-255, December 1990. 2 fig, 6 tab, 26 ref.

Descriptors: *Atrazine, *Deltamethrin, *Fish eggs, *Lindane, *Pesticide toxicity, *Teratogenic effects, *Toxicity, *Toxicology, *Water pollution effects, *Zebra fish, Acute toxicity, Animal tissues, Chronic toxicity, Edema, Fish pathology, Lethal limit.

Fertilized eggs of zebrafish were exposed under flow-through conditions to several concentrations of the following pesticides: lindane 40, 80 110, 130, and 150 mg/L; atrazine 300, 1300, and 9100 mg/L; deltamethrin 0.5, 0.8, and 1.2 mg/L. Hatching abnormalities in development (external deformations, edema, etc.), and mortality were recorded over a period of 35 days. At the end of the experiment, the body lengths of the fish were measured. Survival of juvenile fish after 35 days was reduced by increasing concentrations of all xenobiotics tested; lindane enhanced the mortality from 110 mg/L and atrazine from 1300 mg/L. Deltamethrin showed an effect even at the lowest test concentration (0.5 mg/L). Other parameters were affected differently: hatching rate was reduced only by deltamethrin (from 0.8 mg/L); lindane caused a decrease in growth (40 mg/L) but had no effect on other parameters. Atrazine increased the number of deformations and edema (1300 mg/L) but did not influence hatching rate and growth. The sensitivity of the early life stages to the pesticides was compared with the acute toxicity data (LC-50) of adult zebrafish. The early life stages were less sensitive to lindane (118 versus 75 mg/L), whereas in the case of atrazine (1300 versus 37,000 mg/L) and deltamethrin (0.5 versus 2 mg/L, the lowest concentration tested)) larvae were more sensitive. (Author's abstract)
W91-05996

DIFFERENTIAL EFFECTS OF MERCURIAL COMPOUNDS ON THE ELECTROOLFACTOGRAM (EOG) OF SALMON (SALMO SALAR L).
Oslo Univ. (Norway). Dept. of Biology.
E. Baatrup, K. B. Doving, and S. Winberg.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 269-276, December 1990. 4 fig, 31 ref.

Descriptors: *Electroolfactograms, *Fish physiology, *Mercury, *Olfactometry, *Salmon, *Water pollution effects, Chemoreception, Mercuric chloride, Methylmercuric chloride, Olfactory epithelium, Sense organs.

The effects on the salmon electroolfactogram (EOG) of the two mercurials, mercuric chloride and methylmercuric chloride were studied. The EOG responses were evoked by stimulating the olfactory epithelium with 340 milli M L-alanine for 10 sec every minute during a 1-hr period. Each EOG response consisted of an initial peak component followed by a sustained component with an amplitude about 40% below the peak value. Three experimental series, each comprising six fish, were carried out. In the first series, the rosette was irrigated solely with artificial fresh water. In the two other series, a 5-min exposure to mercuric chloride or methylmercuric chloride was included after 10 min and a 15-min exposure after 45 min. The mercuric ion eliminated the peak response within 2 min and suppressed the sustained response to about 35%. During the subsequent irrigation with mercury-free fresh water, both EOG components regained about 50% of their initial amplitudes. In contrast, methylmercury induced a steady and parallel deadline of both the peak and the sustained responses, which were not reversed by rinsing the epithelium with fresh water. The results of this study demonstrate the vulnerability of the olfactory receptor function in fish to mercury exposure even to brief exposures. Also, they show the very different effects of inorganic and organic mercurials upon the EOG. The impairment caused by the inorganic mercuric ion may to some extent be reversed, but methylmercury presumably causes an irreversible blocking of receptor function. (See also W91-05999) (Author's abstract)
W91-05998

SAFETY ASSESSMENT OF SELECTED INORGANIC ELEMENTS TO FRY OF CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA).
National Fisheries Contaminant Research Center, Yankton, SD. Field Research Station.
S. J. Hamilton, and K. J. Buhl.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 307-324, December 1990. 2 fig, 4 tab, 43 ref. San Joaquin Valley Drainage Program, California and U. S. Department of the Interior.

Descriptors: *Arsenic compounds, *California, *Heavy metals, *Salmon, *San Joaquin Valley, *Toxicity, *Toxicology, *Water pollution effects, Arsenate, Arsenite, Brackish water, Cadmium, Copper, Freshwater, Mercury, Relative element toxicity, San Luis Drain, Selenium, Silver, Vanadium, Zinc.

The acute toxicities of arsenate, arsenite, cadmium, chromate, copper, mercury, silver, vanadium, and zinc were determined, individually and in two environmentally relevant mixtures, to two life stages of chinook salmon in reconstituted fresh and brackish waters that simulated potential conditions in the San Joaquin Valley, California. The relative individual toxicities of the elements varied over four orders of magnitude; from most toxic to least toxic, the rank order was cadmium > copper > mercury > zinc > vanadium > arsenite > arsenate > chromate (no definitive tests for silver). In general, young fish tested in fresh water were more sensitive to the individual elements and the two mixtures than were advanced fry tested in brackish water. A 13-element mixture simulating concentrations in the San Luis Drain had the same toxicity to fish as the same mixture plus selenate and selenite, thus demonstrating that the presence of selenium at its environmental ration in the mixture contributed no toxicity in short-term tests. As judged by a comparison of the individual acute values for salmon to the expected environmental concentrations in the San Luis Drain, the margins of uncertainty for cadmium and copper in both waters, zinc in fresh water, and mercury in brackish water were less than 100, whereas for the two environmental mixtures the margins were less than 15 in both test waters. These low margins of uncertainty, especially for the mixtures, indicate a high potential for environmental hazard to chinook salmon in the reconstituted waters tested. (Author's abstract)
W91-06000

COMPARATIVE TOXICITY OF INORGANIC CONTAMINANTS RELEASED BY PLACER MINING TO EARLY LIFE STAGES OF SALMONIDS.
National Fisheries Contaminant Research Center, Yankton, SD. Field Research Station.
K. J. Buhl, and S. J. Hamilton.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 325-342, December 1990. 7 tab, 48 ref.

Descriptors: *Alaska, *Arsenic, *Grayling, *Heavy metals, *Mine wastes, *Montana, *Salmon, *Toxicity, *Toxicology, *Trout, *Washington, *Water pollution effects, Copper, Lead, Metal speciation, Placer mining, Synergistic effects, Zinc.

The acute toxicities of four trace inorganics associated with placer mining were determined, individually and in environmentally relevant mixtures, to early life stages of Arctic grayling (Thymallus arcticus) from Alaska and Montana, coho salmon (Oncorhynchus kisutch) from Alaska and Wash-

ington, and rainbow trout (Oncorhynchus mykiss) from Montana. The descending rank order of toxicity to all species and life stages was copper > zinc > lead > arsenic. For each of the three species, sensitivity to the inorganics was greater in juveniles than in alevins or in swim-up fry. Arctic grayling from Alaska were more sensitive than the other species tested, including Arctic grayling from Montana. For Arctic grayling, sensitivity to all four inorganics was significantly greater in swim-up fry from Alaska than in alevins from Montana, and sensitivity to arsenic and copper was significantly greater in juveniles from Alaska than in juveniles from Montana. In tests with environmentally relevant mixtures (based on ratios of concentrations measured in streams with placer mining) of these four inorganics, copper was identified as the major toxic component because it accounted for greater or equal to 97% of the summed toxic units of the mixture, and an equitoxic mixture of these inorganics showed less-than-additive toxicity. Total and total recoverable copper concentrations reported in five Alaskan streams with active placer mines were higher than the acutely toxic concentrations, either individually or in mixtures, that the authors found to be acutely toxic to Arctic grayling and coho salmon from Alaska. However, caution should be used when comparing these results obtained in clear water to field situations, because speciation and toxicity of these inorganics may be altered in the presence of sediments suspended by placer mining activities. (Author's abstract)
W91-06001

CATCH-AND-RELEASE MANAGEMENT OF A TROUT STREAM CONTAMINATED WITH PCBS.
Connecticut Dept. of Environmental Protection, Harwinton. Inland Fisheries Div.
For primary bibliographic entry see Field 8I.
W91-06030

BIOLOGICAL EFFECTS OF PETROLEUM HYDROCARBONS: PREDICTIONS OF LONG-TERM EFFECTS AND RECOVERY.
Woods Hole Oceanographic Institution, MA.
J. M. Capuzzo.
Northwest Science NOSCAX, Vol. 64, No. 5, p 247-249, November 1990. 1 tab, 12 ref.

Descriptors: *Fate of pollutants, *Oil pollution, *Oil spills, *Path of pollutants, *Water pollution effects, Bioaccumulation, Biological effects, Ecological effects, Hydrocarbons, Marine organisms.

Biological effects of petroleum hydrocarbons on marine organisms and ecosystems are dependent on the persistence and bioavailability of specific hydrocarbons, the ability of organisms to accumulate and metabolize various hydrocarbons, the fate of metabolized products, and the interference of specific hydrocarbons with normal metabolic processes that may alter an organism's chances for survival and reproduction in the environment. In considering the long-term effects of petroleum hydrocarbons on marine ecosystems it is important to ascertain what biological effects may result in subtle ecological changes, changes in community structure and function, and possible impairment of fisheries resources. It is also important to understand which hydrocarbons persist in benthic environments and the sublethal effects that lead to reduced growth, delayed development and reduced reproductive effort, population decline and the loss of that population's function in marine communities. Only through a multi-disciplinary approach to the study of the fate, transport and effects of petroleum hydrocarbons on marine ecosystems will there be a significant improvement in the ability to predict the long-term effects of oil spills and to elucidate the mechanisms of recovery. (White-Reimer-PTT)
W91-06031

ENVIRONMENTAL STUDIES OF A MARINE WASTEWATER DISCHARGE FROM A SULPHITE PULP MILL--EXAMPLE OF A GENERAL STUDY APPROACH FOR MARINE INDUSTRIAL DISCHARGES.
Region of Storstrom, Parkvej 37, DK-4800 Nykobing F., Denmark.
For primary bibliographic entry see Field 5B.
W91-06055

STUDY OF THE EUTROPHICATION OF NORTH LAKE, WESTERN AUSTRALIA.
Murdoch Univ. (Western Australia). School of Biological and Environmental Sciences.
B. K. McDougall, and G. E. Ho.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 163-173, 1991. 4 fig, 1 tab, 34 ref.

Descriptors: *Algae, *Australia, *Chlorophyll a, *Eutrophication, *Nutrients, *Urban hydrology, *Water pollution effects, *Wetlands, Conductivity, Lakes, Microcystis, Nutrient removal, Phosphorus, Sediment chemistry.

North Lake is an urban freshwater wetland, and like other wetlands in the Perth metropolitan area, Western Australia, it has become nutrient enriched with the accompanying problems of algal blooms, decay, odor, infestation of midges, and aesthetic deterioration. A study of the water quality of the lake was undertaken to quantify the variation of phosphorus, nitrogen and chlorophyll-a, and the sediment store of nutrients and their release with pH. Ten sites around the lake were sampled weekly from September 1987 to May 1988. Samples were analyzed for pH, conductivity, chlorophyll-a, and various nutrients. A Secchi disc was used to monitor light penetration. Sediment samples were collected at three different times during the study and evaluated for pH, water content, organic content, carbonate content, and several states of phosphorus. The dominant algae in the lake, Microcystis, was found to be limited in growth by nitrogen because of the high availability of phosphorus (greater than 0.1 mg/L), and likely by light because of self-shading (chlorophyll-a greater than 0.3 mg/L). Sediments released a substantial amount of nutrients as pH rose above 8.5. Together with a parallel study of the nutrient budget of the lake, a management strategy has been derived to overcome the problem of nutrient enrichment that could be applied to other wetlands in the metropolitan region. Possible nutrient reduction strategies include treatment of runoff, nutrient inactivation, dredging, and chemical control of algae. (Author's abstract)
W91-06056

OCCURRENCE AND SIGNIFICANCE OF TOXIC CYANOBACTERIA IN SOUTHERN AFRICA.
Council for Scientific and Industrial Research, Pretoria (South Africa). Div. of Water Technology.
For primary bibliographic entry see Field 5B.
W91-06057

SEWAGE-RELATED IMPACT ON KUWAIT'S MARINE ENVIRONMENT--A CASE STUDY.
Kuwait Inst. for Scientific Research, Safat. Environmental and Earth Sciences Div.
S. Al-Muzaini, O. Samhan, and M. Hamoda.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 181-189, 1991. 2 fig, 29 ref.

Descriptors: *Kuwait, *Marine pollution, *Wastewater management, *Water pollution effects, *Water pollution sources, Wastewater, Wastewater treatment.

Sewage discharge has been found to exert different impacts on Kuwait's marine environment, ranging from fish kills and localized smothering of benthic organisms and microbial pollution to potential wider impacts on overall marine productivity. These impacts are due to a combination of unique local environmental conditions such as high ambient air temperatures, high rates of dust fallout and creeping sands, and the prevalence of wide intertidal flats; and specific problems in the sewage treatment plants including the high strength and anaerobicity of sewage, lack of alternative routes from peripheral pumping stations to a central treatment plant that is biochemically overloaded, emergency discharge through short outfalls onto wide intertidal flats, and discharges from premises that are not connected to a sewer system. Recommendations to alleviate these impacts include speeding up sewer flows, creating alternative routes to the treatment plants, upgrading and expanding the treatment plants, preventing discharge of sewage effluent to the tidal flats, and connecting all sewage-generating premises to the sewage system. (Author's abstract)
W91-06058

WATER QUALITY AND HEALTH.
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
W. Kreisel.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 201-209, 1991. 1 fig, 9 ref.

Descriptors: *Developing countries, *Public health, *Water quality control, *Water quality standards, *Water reuse, *Water treatment, Drinking water, Pathogens, Water management, Water supply.

Water quality can affect human health in various ways: through breeding of vectors, presence of pathogenic protozoa, helminths, bacteria and viruses, or through inorganic and organic chemicals. While traditional concern has been with pathogens and gastro-intestinal diseases, chemical pollutants in drinking water supplies have in many instances reached proportions which affect human health, especially in cases of chronic exposure. Treatment of drinking water, often grossly inadequate in developing countries, is the last barrier of health protection, but control at source is more effective for pollution control. Several World Health Organization (WHO) programs of the International Drinking Water Supply and Sanitation Decade have stimulated awareness of the importance of water quality in public water supplies. Three main streams have been followed during the eighties; guidelines for drinking water quality, guidelines for wastewater reuse and the monitoring of freshwater quality. Following massive investments in the community water supply sector to provide people with adequate quantities of drinking water, it becomes more and more important to also guarantee minimum quality standards. This has been recognized by many water and health authorities in developing countries and, as a result, WHO cooperates with many of them in establishing water quality laboratories and pollution control programs. (Author's abstract)
W91-06060

EPIDEMIOLOGICAL STUDY OF BEACH WATER POLLUTION AND HEALTH-RELATED BATHING WATER STANDARDS IN HONG KONG.
Hong Kong Environmental Protection Dept., Wan Chai.
For primary bibliographic entry see Field 5A.
W91-06066

CASE HISTORY: MINIMATA MERCURY POLLUTION IN JAPAN - FROM LOSS OF HUMAN LIVES TO DECONTAMINATION.
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W91-06070

MECHANISM OF ABRUPT INCREASE IN TOXICITY OF ORGANOPHOSPHOROTHIONATES TO TIGER SHRIMP LARVAE WITH PROGRESS OF STAGES.
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
K. Kobayashi, R. M. Rompas, N. Imada, and Y. Oshima.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 487-496, 1991. 2 fig, 3 tab, 11 ref.

Descriptors: *Japan, *Organophosphorus pesticides, *Pesticides, *Tiger shrimp, *Toxicity, *Water pollution effects, Invertebrates, Larval growth stage, Marine animals, Marine fisheries, Metabolism, Shrimp.

The tiger shrimp (Penaeus japonicus) is an important species for coastal fisheries in Japan; however, the shrimp displays high susceptibility to organophosphorus pesticides. There is an abrupt increase in the toxicity of organophosphorus pesticides to the tiger shrimp with the advancing of larval stages. The toxicity of the pesticides to shrimp larvae and the inhibition of larval acetylcholinesterase (AChE) by the pesticides, and the metabolism of fenitrothion (FS) in the larvae was studied at different stages. The toxicity of the thiono-forms to the larvae increased abruptly with the progress of stages, whereas that of oxo-forms was unchanged from nauplius to postlarva. The susceptibility of larval AChE to each pesticide was almost unchanged in these stages. FS metabolic activity of zoea was very low, but the activity increased abruptly with their growth and resulted in the increase of fenitro-oxen which displays extremely high toxicity as compared with FS. The increase in the toxicity of thiono-forms to shrimp larvae with the progress of the stages must be due to the increase in the oxidative desulfuration activity. (Author's abstract)
W91-06092

PRELIMINARY INVESTIGATION ON ACIDIFICATION OF GROUND WATER IN FINNISH WELLS.
Water and Environment Research Inst., Helsinki (Finland).
K. Korkka-Niemi, and H. Laikari.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 535-543, 1991. 2 fig, 7 tab, 8 ref.

Descriptors: *Acid rain, *Acid rain effects, *Acidic water, *Acidification, *Finland, *Sulfur, Alkalinity, Groundwater pollution, Hydrologic data collections, Well data, Wells.

Information from approximately one hundred dug wells in five different areas in Finland was analyzed to investigate the acidification of groundwater. The wells were selected from a database generated in 1958-1959, and the wells were resampled in 1989. The fallout of sulfur compounds was used to determine the location of wells to be sampled. The pH value and degree of alkalinity of well water were used to compare the changes in groundwater quality over the last thirty years. The pH and alkalinity have systematically declined in all the areas sampled-most noticeably in areas of southwestern and southeastern Finland subject to major sulfur compound fallout. The physical condition of the wells has deteriorated during the last thirty years; about half of the wells are receiving surface waters, making interpretation of results difficult. Wells without surface water intrusion show clear signs of acidification. Because the number of wells and areas of investigation are relatively small, no decisive conclusions should be drawn concerning the whole country. (Tappert-PTT)
W91-06097

EFFECTS OF A MIXTURE OF CU, CD, HG AND ZN ON MARINE PLANKTON: MARINE ECOSYSTEM ENCLOSURE EXPERIMENT.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
J. Wu.
Acta Oceanologica Sinica, Vol. 9, No. 1, p 145-150, 1990. 7 fig, 8 ref.

Descriptors: *Heavy metals, *Marine environment, *Plankton, *Toxicity, *Water pollution effects, Bacteria, Cadmium, China, Chlorophyll, Copepods, Copper, Diatoms, Lead, Marine bacteria, Mercury, Nitrates, Nutrients, Phosphates, Phytoplankton, Primary productivity, Xiamen Bay, Zooplankton.

Five experimental ecosystems were employed in April, 1985 to test the effects of a mixture of Cu, Cd, Hg, Pb, and Zn on a subtropical planktonic ecosystem in Xiamen Bay, Xiamen, China. The chlorophyll a maxima and the primary productivity peak in the high-metal enclosure were delayed for 6 days compared to the control and low-metal enclosures. The phytoplankton cell density in the metal-treated enclosures followed the chlorophyll a concentration very closely. Microflagellates were generally more important than diatoms. Zooplankton was significantly affected, especially by the high metal concentrations. The herbivorous copepods were most dominant in the control enclosures, but they drastically decreased in the high-metal enclosure. The carnivorous copepods were also suppressed by the high metal concentration. However, the larvaceans were the most seriously inhibited, with few or none in all metal-treated enclosures to the end of the experiment (3 weeks). Bacterial biomass was similar in control and metal-treated enclosures, and bacterial productivity was markedly higher in the metal-treated enclosures. Because a mixture of metals was used in this experiment, it is impossible to conclude which metal is the most toxic. (Doria-PTT)
W91-06102

EFFECTS OF SEDIMENT FROM AN INDUSTRIAL OUTFALL AREA ON A MARINE PLANKTONIC ECOSYSTEM.
National Bureau of Oceanography, Xiamen (China). Third Inst. of Oceanography.
J. Wu.
Acta Oceanologica Sinica, Vol. 9, No. 1, p 151-158, 1990. 6 fig, 12 ref.

Descriptors: *Industrial wastes, *Marine environment, *Plankton, *Sediments, *Water pollution effects, *Xiamen Bay, Bacteria, China, Chlorophyll a, Diatoms, Heavy metals, Light penetration, Marine bacteria, Outfall, Photosynthesis, Phytoplankton, Primary productivity, Zooplankton.

Sediment from the Xiamen industrial area was added to marine ecosystem enclosures to test the effects on the planktonic communities in Xiamen Bay, China, in April, 1985. Sediments were added at two concentrations, 11.2 and 112 ppm dry weight. A peak in primary production and chlorophyll occurred in the control enclosure on day 10-13, composed mostly of centric diatoms. There was little increase in chlorophyll and primary productivity in the low-sediment and high-sediment enclosures despite a short bloom on day 8 in the high-sediment enclosure. There was little difference in the abundance of herbivorous zooplankton, carnivorous copepods, or larvaceans between sediment-treated enclosures and controls. Bacterial numbers showed little change due to sediment loading except during the last few days when the numbers in the control enclosures decreased markedly. It is concluded that sediment loads up to 112 ppm dry wt reduced the phytoplankton cell numbers, chlorophyll a, and primary productivity by decreasing light penetration in the water column, but induce few changes in zooplankton and bacterial abundances. (Doria-PTT)
W91-06103

PHOSPHATE LIMITATION OF PHYTOPLANKTON GROWTH IN THE CHANGJIANG ESTUARY.
Xiamen Univ. (China). Dept. of Oceanography.
M. Hu, Y. Yang, C. Xu, and P. J. Harrison.
Acta Oceanologica Sinica, Vol. 9, No. 3, p 405-411, 1990. 5 fig, 6 ref.

Descriptors: *Estuarine environment, *Eutrophication, *Nutrient requirements, *Phytoplankton, *Water pollution effects, Algal growth, Aquatic productivity, Bioassay, Biomass, Chang Jiang Estuary, China, Estuaries, Growth, Limiting nutrients, Nitrogen, Nutrients, Phosphorus.

Bioassays were performed in the laboratory with Phaeodactylum tricornutum, Chaetoceros didymus, C. calcitrans, and Heterogloea sampled from the Changjiang Estuary (China) in spring and summer, 1986. Results indicated that both nitrogen and phosphorus limit phytoplankton growth in the medium at N:P ratios between 8 and 30. Nitrogen limits phytoplankton production in the medium at N:P<8, while phosphorus is the limiting nutrient at N:P>30. Generally, N:P in the Changjiang Estuary waters is 2 times higher than the Redfield ratio. The bioassay experiments with high N:P water samples showed that phytoplankton production is limited by phosphorus. Phytoplankton appears to give priority to the uptake of phosphorus at all times, and the optimum N:P for phytoplankton growth was determined to be 18. (Author's abstract)
W91-06105

BIOMARKERS OF ENVIRONMENTAL CONTAMINATION.
For primary bibliographic entry see Field 5A.
W91-06176

LIVER STRUCTURAL ALTERATIONS ACCOMPANYING CHRONIC TOXICITY IN FISHES: POTENTIAL BIOMARKERS OF EXPOSURE.
California Univ., Davis. School of Veterinary Medicine.
For primary bibliographic entry see Field 5A.
W91-06177

HISTOPATHOLOGY OF ATLANTIC TOMCOD: A POSSIBLE MONITOR OF XENOBIOTICS IN NORTHEAST TIDAL RIVERS AND ESTUARIES.
Louisville Univ., KY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W91-06178

CROAKER (NIBEA MITSUKURII) AND THE SEA CATFISH (PLOTOSUS ANGUILLARIS): USEFUL BIOMARKERS OF COASTAL POLLUTION.
Shizuoka Univ. (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5A.
W91-06179

SUBLETHAL RESPONSES OF PLATICHTHYS STELLATUS TO ORGANIC CONTAMINATION IN SAN FRANCISCO BAY WITH EMPHASIS ON REPRODUCTION.
Lawrence Livermore National Lab., CA. Environmental Sciences Div.
R. B. Spies, J. J. Stegeman, D. W. Rice, B. Woodin, and P. Thomas.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 87-121, 9 fig, 9 tab, 47 ref. DOE Contract W-7405-Eng-48.

Descriptors: *Bioindicators, *Flounders, *Organic compounds, *San Francisco Bay, *Spawning, *Sublethal effects, *Water pollution effects, California, Chlorinated hydrocarbon insecticides, Ecotoxicology, Fish eggs, Fish physiology, Liver, Oakland, Polychlorinated biphenyls, Toxicity.

Two large collecting efforts were made--one during the middle part of the reproductive cycle (November to early December 1986) and one at the time of spawning (February to March 1987), in San Francisco Bay, on the starry flounder Platichthys stellatus. For the '1986' period P. stellatus were collected from five localities (four in San Francisco Bay and one near the mouth of the Russian River). A variety of tests were made on these fish that might indicate the nature and extent of contaminant exposure, the alteration of normal reproductive processes, and genetic effects: (1) trace organic contaminants in the liver, mainly chlorinated hydrocarbons; (2) constituents and in vitro enzymatic activities of the hepatic P-450 microsomal system; (3) oocyte development in maturing females; (4) plasma concentrations of vitellogenin and titers of sex steroids; and (5) the incidence of micronuclei in circulating erythrocytes. In general, hepatic concentrations of chlorinated pesticides did not differ significantly between sites but p,p'-DDT, o,p'-DDT, transnanochlor and mirex were highest at Oakland. Ten of the thirteen PCB congeners with five or more chlorine atoms had their highest concentrations in Oakland fish. Two of the eight large females from the most contaminated site, Oakland, did not have vitellogenic oocytes, indicating complete inhibition of vitellogenesis in these fish during the 1986-1987 reproductive season. Since their plasma had concentrations of vitellogenin and titers of estradiol typical of immature females it appears probable that the gonadotropin signal was either inhibited or

ineffective in triggering estrogenesis. In immature females plasma estradiol was correlated with P-450E and P-450 content of hepatic microsomes, suggesting that induced fish may either have higher rates of estradiol production or lower rates of estradiol hydroxylation, or both. (See also W91-06176) (Lantz-PTT)
W91-06180

HEPATIC ENZYMES AS BIOMARKERS: INTERPRETING THE EFFECTS OF ENVIRONMENTAL, PHYSIOLOGICAL AND TOXICOLOGICAL VARIABLES.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06181

MACROPHAGE RESPONSES OF ESTUARINE FISH AS BIOINDICATORS OF TOXIC CONTAMINATION.
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5A.
W91-06182

BIOLOGICAL MONITORING: TESTING FOR GENOTOXICITY.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06183

DNA ADDUCTS IN MARINE MUSSEL MYTILUS GALLOPROVINCIALIS LIVING IN POLLUTED AND UNPOLLUTED ENVIRONMENTS.
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
B. Kurelec, A. Garg, S. Krca, and R. C. Gupta.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 217-227, 3 fig, 28 ref. U.S.-Yugoslavia Joint Board on Scientific and Technological Cooperation, J.F. Project 868 and EPA Cooperative Agreement CR-813840.

Descriptors: *DNA, *Fate of pollutants, *Marine environment, *Mussels, *Wastewater pollution, *Water pollution effects, *Water pollution sources, Aminofluorene, Bioindicators, Ecotoxicology, Industrial wastewater, Oil pollution, Toxicity.

A generally applicable 32-P post-labelling assay was used to examine for the presence of DNA adducts in mussels experimentally exposed to known carcinogens and in mussels collected from sites impacted by wastewaters. Mussels exposed to seawater artificially polluted with 2-aminofluorene showed exclusively an adduct which was identified as dG-C8-2-aminofluorene. Under the same experimental conditions, Diesel-2 oil did not induce any detectable adducts. When mussel digestive gland DNA was collected and analyzed from one unpolluted site, two moderately impacted sites, and one site heavily impacted by cannery wastewaters, mussel DNA from the unpolluted and only one moderately polluted site showed the presence of 6 to 10 adducts. This indicates they were not related to the pollution. This was further supported by the absence of dose-related adducts. Clear evidence for the presence of pollution-related DNA adducts was, however, found in juvenile mussels collected from an oil refinery site. One major and three minor adducts were detected in these mussels with no adducts detected in juvenile mussels from an unpolluted site. Results indicate that while mussels are capable of metabolizing 2-aminofluorene to a DNA binding species, the environmental pollutants may be metabolized only selectively. Further, the mussel digestive gland DNA also contained DNA modifications ('natural adducts') which are unrelated to pollutants and their presence appeared to be sex and season dependent. (See also W91-06176) (Author's abstract)
W91-06184

C-K-RAS ONCOGENES: PREVALENCE IN LIVERS OF WINTER FLOUNDER FROM BOSTON HARBOR.
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
G. McMahon, L. J. Huber, M. J. Moore, J. J. Stegeman, and G. N. Wogan.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 229-235, 1 tab, 20 ref. US Public Health Service Grant CA44306.

Descriptors: *Boston Harbor, *Flounders, *Liver, *Oncogenes, *Water pollution effects, Bioassay, Cancer, DNA, Ecotoxicology, Fish physiology, Laboratory methods, Organic compounds, Polycyclic aromatic hydrocarbons, Sediment contamination, Toxicity.

A high incidence of tumors in fish occurs in several water systems of coastal North America. An association of such tumors with the presence of environmental chemicals, such as polycyclic aromatic hydrocarbons (PAH) or polychlorinated hydrocarbons, suggests a possible chemical etiology for their induction. Winter flounder (Pseudopleuronectes americanus) were collected from areas of Boston Harbor where sediments were heavily contaminated with PAH and other organic compounds. Livers from these winter flounder were examined for the presence of oncogenes by transfection of DNA into NIH3T3 mouse fibroblasts. Tissues analyzed contained histopathologic lesions including abnormal vacuolation, biliary proliferation, and, in many cases, hepatocellular and cholangiocellular carcinomas. Fibroblasts transfected with liver DNA samples from 7 of 13 animals were effective in the induction of subcutaneous sarcomas in nude mice. Further analysis revealed the presence of flounder c-K-ras oncogenes in all subcutaneous tumors examined. Direct DNA sequencing and allele-specific oligonucleotide hybridization following polymerase chain reaction DNA amplification of the tumor DNA showed mutations in the 12th codon in this gene. Analysis of DNA of all nude mouse tumors as well as all 13 diseased flounder livers showed mutations at this codon. Liver DNA samples from 5 histologically normal livers of animals from a less polluted site were ineffective in the transfection assay and contained only wild-type DNA sequences. The prevalence of mutations in this gene region correlated with the presence of liver lesions and could signify DNA damage resulting from environmental chemical exposure. (See also W91-06176) (Lantz-PTT)
W91-06185

METAL-BINDING PROTEINS AND PEPTIDES FOR THE DETECTION OF HEAVY METALS IN AQUATIC ORGANISMS.
Wisconsin Univ.-Milwaukee. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W91-06186

METALLOTHIONEIN AS A BIOMARKER OF ENVIRONMENTAL METAL CONTAMINATION: SPECIES-DEPENDENT EFFECTS.
Mississippi Univ., University. Dept. of Pharmacology.
For primary bibliographic entry see Field 5A.
W91-06187

METALLOTHIONEIN: A POTENTIAL BIOMONITOR OF EXPOSURE TO ENVIRONMENTAL TOXINS.
California Inst. of Tech., Pasadena. Div. of Biology.
For primary bibliographic entry see Field 5A.
W91-06188

EFFECT OF CADMIUM ON PROTEIN SYNTHESIS IN GILL TISSUE OF THE SEA MUSSEL MYTILUS EDULIS.
Utrecht Rijksuniversiteit (Netherlands). Dept. of Experimental Zoology.
M. B. Veldhuizen-Tsoerkan, D. A. Holwerda, C. A. Van der Mast, and D. I. Zandee.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 289-306, 11 fig, 2 tab, 35 ref.

Descriptors: *Cadmium, *Gills, *Laboratory methods, *Mussels, *Proteins, *Water pollution effects, Electrophoresis, Heavy metals, Marine environment, Sulfur radioisotopes, Tissue analysis, Toxicity.

Cellular toxicity of cadmium was studied in the gill tissue of the sea mussel, Mytilus edulis. Mussels were exposed to cadmium chloride at 50 or 250 microgram Cd/L for short periods. Then the gills were excised and incubated with 35-S-methionine or cysteine for 4 hr. Uptake of radiolabeled amino acids by the isolated gills was not affected by Cd, whereas the incorporation of label was significantly decreased after Cd exposure. Two dimensional gel electrophoresis was used to analyze the de novo synthesized gill proteins. It revealed that the expression of particular proteins was differently altered by Cd. One dimensional gel analysis by 35-S-cysteine labeled gill proteins demonstrated that Cd induced, in a concentration dependent manner, a cysteine-rich protein with a molecular weight of approximately 13 kDa, consisting of two isomers with low isoelectric points. (See also W91-06176) (Author's abstract)
W91-06189

SENTINEL SPECIES AND SENTINEL BIOASSAY.
Missouri Univ.-Columbia. Environmental Trace Substances Research Center.
For primary bibliographic entry see Field 5A.
W91-06190

APPLICATION OF BIOINDICATORS IN ASSESSING THE HEALTH OF FISH POPULATIONS EXPERIENCING CONTAMINANT STRESS.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06191

COMPARATIVE EVALUATION OF SELECTED MEASURES OF BIOLOGICAL EFFECTS OF EXPOSURE OF MARINE ORGANISMS TO TOXIC CHEMICALS.
National Ocean Service, Seattle, WA. Ocean Assessments Div.
E. R. Long, and M. F. Buchman.
IN: Biomarkers of Environmental Contamination. Lewis Publishers, Chelsea, Michigan. 1990. p 355-394, 1 fig, 8 tab, 55 ref.

Descriptors: *Bioassay, *Bioindicators, *Comparison studies, *Laboratory methods, *San Francisco Bay, *Toxicity, *Water pollution effects, Amphipods, Biochemistry, Chemical analysis, Cytochromes, Marine life, Mussels, Physiological ecology, Sediment analysis, Sediments, Water analysis.

The relative responsiveness and sensitivity of selected measures of biological effects to a range of contaminant concentrations was evaluated in the San Francisco Bay area in 1987. The overall approach chosen for the evaluation involved analyses of samples collected in the field at sites that were presumed to represent a range in chemical contamination. The biological measures that were evaluated included: five types of sediment toxicity tests; analyses of macrobenthos community composition; sediment profiling photography; induction of hepatic aryl hydrocarbon hydroxylase; induction of hepatic cytochrome P-450 enzymes; plasma steroid hormone concentration; reproductive success; and incidence of micronuclei in erythrocytes of fish. The biological tests were performed with subsamples of samples that were also analyzed for chemical concentration. The concentration of many analytes in sediments differed by roughly an order magnitude between the least and the most contaminated sampling sites. A toxicity test of abnormal development of Mytilus edulis larvae had the highest sensitivity, analytical precision, and discriminatory power of the tests that were evaluated. The relatively highly tested and developed Rhepoxynius abronius test of survival had very high sensitivity, analytical precision, and discriminatory power. Fish from two sites in San Francisco Bay were generally more contaminated with a mixture of compounds than those from a

coastal reference site and a reference site in the Bay. However, the distinction in the chemical concentrations between sites was not as clear as the sediments. In general, the suite of total cytochrome P-450/EROD/P-450E measures in the livers of the fish appeared to be relatively sensitive, weakly correlated with some tissue contaminant data, relatively low in variability among fish from the same site, and inducible over a similar response range among species. (See also W91-06176) (Lantz-PTT)
W91-06192

USE OF BIOMARKERS IN ECOLOGICAL RISK ASSESSMENT.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06193

WATERBORNE GIARDIASIS.
CH Diagnostic & Consulting Service, Fort Collins, CO.
For primary bibliographic entry see Field 5F.
W91-06207

FERTILITY OF DOMESTIC SEWAGE AND EUTROPHICATION IN ESTUARINE HARBOR.
Xiamen Univ. (China). Inst. of Environmental Science.
W. Yuduan, Z. Jiye, Z. Zhihong, and L. Xiaohong.
Acta Oceanologica Sinica, Vol. 9, No. 2, p 277-282, 1990. 4 fig, 5 ref.

Descriptors: *China, *Estuaries, *Eutrophication, *Harbors, *Red tide, *Water pollution effects, Algal growth, Inorganic compounds, Nitrogen, Phosphorus, Phytoplankton, Turbidity, Wastewater pollution.

Eutrophication and red tide in the seawater of estuaries and harbors have become more frequent in recent years. The direct source of pollution is generally domestic sewage. In spite of primary and secondary treatment of sewage discharged into seawater, concentrations of P and N, and their ratio basically have remained unchanged. The concentration and partition ratio of various compounds of nutrients in domestic sewage were determined. The transformation and migration among the compounds, as well as their biological effects during sewage-seawater mixing were simulated in the laboratory. Sewage water was collected from the sewage pool in Xiamen University, China and seawater was collected from West Xiamen Harbor. When laboratory results were compared with field observations it was found that: (1) The suitable ratio range of dissolved inorganic nitrogen/dissolved inorganic phosphorus in seawater for growth of phytoplankton in subtropical estuary and harbor was quite wide. It could grow well even in the atom ratio range of 15-55 and was independent of the variation in levels of N and P. (2) The transformation rate among the phosphorus compounds was within the range of 0.5 to 1.11 micromoles/day. (3) Phytoplankton took up P prior to N during its growth. The growth rate of Skeletonema costatum (the major species) was 0.34-0.58/day and for field algae, 0.30-0.31/day. (4) The red tide species Prorocentrum micans could become the dominant species to a density of 10,000,000 cells/L after Skeletonema costatum blooms and phosphorus was almost exhausted. Although eutrophication may bring out red tide in estuarine harbor, the acceleration of degradation, transportation and precipitation of nutrients by turbid water was beneficial to the alleviation of eutrophication and red tide. (Mertz-PTT)
W91-06221

ACID RAIN.
Central Electricity Generating Board, London (England). Environmental Policy Dept.
For primary bibliographic entry see Field 5B.
W91-06236

EFFECTS OF MERCURY ON THE FEEDING BEHAVIOR OF THE MUMMICHOG, FUNDULUS HETEROCLITUS FROM A POLLUTED HABITAT.
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biological Sciences.
J. S. Weis, and A. A. Khan.
Marine Environmental Research MERSDW, Vol. 30, No. 4, p 243-249, 1990. 1 tab, 19 ref.

Descriptors: *Fish behavior, *Mercury, *Sublethal effects, *Toxicity, *Water pollution effects, Fish diets, Fish food organisms, Growth, Mercuric chloride, Methylmercury, New Jersey, Water pollution.

Exposure to sublethal concentrations of toxicants may produce modifications in an animal's behavior that can in turn affect the animal's ability to deal successfully with its environment. Toxicological modification of feeding behavior has received some attention. By altering feeding behavior, pollutants may alter predator/prey interactions, that can in turn, lead to changes in the population of the predator and prey species. Fish living in contaminated environments may exhibit reduced growth that may be due, in part, to the impact of toxicants on prey capture ability. The effects of methylmercury and mercuric chloride on the feeding of Fundulus heteroclitus from Piles Creek, a polluted habitat in Linden, New Jersey were studied. It was found that exposure to 0.01 mg/L of methylmercury for one week had less impact on the prey capture rate than exposure to a similar concentration of mercuric chloride. Exposure to 0.01 mg/L for two weeks or to 0.02 mg/L for one week, of either methylmercury or mercuric chloride, produced significant reductions in feeding rate, compared to controls. In general, the fish were affected to a greater degree by exposure to mercuric chloride than to methylmercury. This is the reverse of the usual order of toxicity, but is in keeping with previous observations on this population, in which gametes and embryos had developed tolerance to methylmercury, but were more susceptible to mercuric chloride. (Mertz-PTT)
W91-06239

ANALYSIS OF THE RELATIONSHIP BETWEEN A SAND-DOLLAR EMBRYO ELUTRIATE ASSAY AND SEDIMENT CONTAMINANTS FROM STATIONS IN AN URBAN EMBAYMENT OF PUGET SOUND, WASHINGTON.
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5A.
W91-06240

EXPERIMENTAL MARINE ECOSYSTEM STUDY OF THE PELAGIC BIOGEOCHEMISTRY OF PENTACHLOROPHENOL.
Dobrocky Seatech Ltd., Sidney (British Columbia).
For primary bibliographic entry see Field 5B.
W91-06241

ROLE OF ALUMINUM AND GROWTH RATE ON CHANGES IN CELL SIZE AND SILICA CONTENT OF SILICA-LIMITED POPULATIONS OF ASTERIONELLA RALFSII VAR. AMERICANA (BACILLARIOPHYCEAE).
Michigan Univ., Ann Arbor. Dept. of Biology.
R. W. Gensemer.
Journal of Phycology JPYLAJ, Vol. 26, No. 2, p 250-258, 1990. 5 fig, 2 tab, 56 ref.

Descriptors: *Acid rain, *Acid rain effects, *Acidification, *Aluminum, *Asterionella, *Diatoms, *Silica, *Water pollution effects, Acid lakes, Growth, Population dynamics.

Changes in cell size and silica content were examined in response to aluminum additions in cultures of the acidophilic diatom Asterionella ralfsii var. americana Korn at pH 6.0. The effects of Al were examined over a range of steady-state growth rates using silica-limited semicontinuous cultures. Additions of >/= 2.8 micromoles/L total Al decreased mean cell length, total surface area, and biovolume up to 40-50%. The effects of Al were dependent on growth rate with the magnitude of size reduction increasing at higher growth rates. The proportion of small (approximately 15-20 micrometers) cell length classes increased relative to large (approximately 50 micrometers length) cell length classes when total Al exceeded 2.8 micromoles/L, particularly at higher growth rates. The relationship between cell quota and steady-state growth rate fit a Droop relationship at 0 and 2.8 micromoles/L total Al, but this fit was highly variable in the presence of Al. Cell quotas in the 6.22 micromoles/L total Al treatment were highest at low growth rates; therefore, a Droop relationship was an inappropriate descriptor of growth rate. Cells also became 30-40% more heavily silicified per unit surface area in the presence of Al and at growth rates >/= 0.22/day. Although the mechanisms responsible for size reductions in response to Al additions are unclear, the relationship between metal concentration and frustule morphology may be useful as an indicator of Al loading to acidified lakes. (Author's abstract)
W91-06249

EFFECTS OF ARSENATE ON GROWTH OF NITROGEN- AND PHOSPHORUS-LIMITED CHLORELLA VULGARIS (CHLOROPHYCEAE) ISOLATES.
Toronto Univ. (Ontario). Dept. of Botany.
I. R. Creed, M. Havas, and C. G. Trick.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 641-650, 1990. 4 fig, 1 tab, 54 ref.

Descriptors: *Algae, *Algal growth, *Arsenic compounds, *Chlorella, *Limiting nutrients, *Water pollution effects, Arsenic, Canada, Japan, Nitrogen, Phosphorus, Photosynthesis, Tolerance, Water pollution.

The effects of arsenate on the growth characteristics of five isolates of the freshwater alga, Chlorella vulgaris Beij., were examined. Two field isolates originated from arsenic-contaminated sites in Yukon, Canada and Kyushi, Japan; two reference isolates were obtained from the University of Texas Culture Collection. One isolate was selected for arsenic-tolerance in the laboratory. All five strains survived in culture solutions containing high arsenate concentrations. Arsenate (1-25 millimolar As) reduced photosynthesis and cell growth, as reflected by induced lag periods, slower growth rates, and lower stationary cell yields. Field isolates had shorter lag periods, higher growth rates, and enhanced cell yields compared to lab isolates when exposed to the same arsenic concentrations. Growth of the phosphorus-limited field strains was stimulated by the addition of arsenic. The cell yield of phosphorus-limited C. vulgarus Yukon, when treated with arsenic, was two times that of the phosphorus-limited control. This pattern was not evident when photosynthesis was used as a measure of cell response. (Author's abstract)
W91-06256

COPPER TOLERANCE OF CHLAMYDOMONAS ACIDOPHILA (CHLOROPHYCEAE) ISOLATED FROM ACIDIC, COPPER-CONTAMINATED SOILS.
Toronto Univ. (Ontario). Inst. for Environmental Studies.
M. R. Twiss.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 655-659, 1990. 1 fig, 3 tab, 27 ref.

Descriptors: *Air pollution effects, *Algae, *Chlamydomonas, *Chlorophyta, *Copper, *Mine wastes, *Soil algae, *Soil contamination, *Water pollution effects, Cyanophyta, Ecological effects, Hydrogen ion concentration, Iron, Nickel, Soil organisms.

The smelting of sulfur-rich copper, nickel, and iron ores in the Sudbury Basin of north-eastern Ontario dates back to 1888 when the first ore roasting yard was established in the area. The algae that inhabit the contaminated soils of this area are predominantly chlorophytes with some cyanobacteria present in less acidic, rehabilitated soils. Similar distributions of soil algae have been reported from comparably devastated land in the Soviet Union. The algae that live in contaminated soils near

Sudbury are believed to be metal tolerant strains that have evolved by the process of selection during the past century in which pollution has been intense in this region. Cells of Chlamydomonas acidophila Negoro, isolated from three soils with different available copper contents (74, 80, and 87 microgram/g), were assayed for their responses to copper. Soil pH ranged from 3.3-3.9. Responses were evaluated using algistatic assays involving five day exposure to copper concentrations from 0.1-100 mg/L at pH 3.8 and 6.6 in defined liquid media. Interspecies and intraspecies comparisons were made between the soil isolates and laboratory strains of C. reinhardtii and C. acidophila. Algistatic copper concentrations of soil isolates were 20-125 times greater than those of the laboratory strain of C. reinhardtii. Concentrations of 0.1 mg Cu/L, or greater, killed the laboratory strain of C. acidophila. Soil isolates of C. acidophila appeared to be copper tolerant; however, there was no conclusive evidence to indicate that the level of copper tolerance in the soil isolates was positively correlated with the level of available copper in the soil. (Mertz-PTT)
W91-06258

METHOD FOR DETECTING AND IDENTIFYING THE LETHAL ENVIRONMENTAL FACTOR ON A DOMINANT MACROBENTHOS AND ITS APPLICATION TO LAKE SHINJI, JAPAN.
Tokyo Univ. (Japan). Ocean Research Inst.
For primary bibliographic entry see Field 5A.
W91-06260

VARIATION IN COMPOSITION AND CONDITION OF THE PACIFIC OYSTER, CRASSOSTREA GIGAS, ALONG A POLLUTION GRADIENT IN MANUKAU HARBOUR, NEW ZEALAND.
Department of Scientific and Industrial Research, Hamilton (New Zealand). Water Quality Centre.
R. D. Pridmore, D. S. Roper, and J. E. Hewitt.
Marine Environmental Research MERSDW, Vol. 30, No. 3, p 13-177, 1990. 3 fig, 4 tab, 49 ref.

Descriptors: *Mollusks, *New Zealand, *Oysters, *Path of pollutants, *Water pollution effects, Chlorinated hydrocarbons, Glycogen, Industrial wastewater, Municipal wastewater, Organotin compounds, Proteins, Urban runoff, Water pollution, Water pollution sources.

The Pacific oyster, Crassostrea gigas Thunberg, is a native of Japan and was accidently introduced into New Zealand probably during the 1960s. Since its introduction, the species has rapidly colonized the northern coastline of the North Island and become the dominant farmed oyster. C. gigas is found in relatively high numbers along the northern shore of Manukau Harbour, which receives inputs of industrial and municipal wastewater, including various organochlorine compounds, and treated sewage effluent and urban runoff from the Auckland metropolitan area. Three physical and four biochemical condition indices were used to assess the condition of the Pacific oyster, C. gigas, down a pollution gradient in Wairopa Channel, Manukau Harbour, New Zealand. Changes in condition along the channel agreed well with the known water quality/pollution gradient. All indices except one (based on protein content) clearly distinguished between polluted and unpolluted sites. Differences in condition were attributable principally to an increase in glycogen content down the pollution gradient. Whereas protein content varied insignificantly among sites, glycogen content was 1.5-1.8 times greater at the less polluted sites and accounted for much of the observed increase in dry flesh weight. Pronounced shell thickening, commonly associated with tributyltin contamination, was also observed at the more polluted sites. (Mertz-PTT)
W91-06261

HAEMATOLOGICAL EFFECTS IN FISHES FROM COMPLEX POLLUTED WATERS OF VISAKHAPATNAM HARBOUR.
Andhra Univ., Waltair (India). Dept. of Zoology.
D. Panduranga Rao, B. Ram Bhaskar, K. Srinivasa Rao, and Y. V. K. Durga Prasad.
Marine Environmental Research MERSDW, Vol. 30, No. 3, p 217-231, 1990. 1 fig, 7 tab, 42 ref.

Descriptors: *Fish physiology, *India, *Sublethal effects, *Toxicity, *Water pollution effects, Blood, Fish, Fishkill, Heavy metals, Lethal effects, Tissue studies, Toxicants, Water pollution.

An understanding of physiological or biochemical changes due to sublethal toxicity is necessary to predict possible lethal effects. Attempts to monitor the influence of toxicants have utilized a variety of techniques to assess histopathological, biochemical and physiological changes. One primary goal of aquatic toxicology is the development of animal screening techniques to measure the degree of environmental contamination. Hematology of fishes provides a useful indication of pollution. Five species of fish from two polluted stations in Visakhapatnam harbor waters (India) were compared hematologically with the same species from two control stations--one at Gostani estuary of Bhimilipatnam and another in the inshore waters of Visakhapatnam coast. All species from polluted waters showed significantly lower erythrocyte numbers, hematocrit, hemoglobin and thrombocyte percentage; and significantly higher mean cell volume, leucocyte numbers and lymphocyte percentage, compared with the controls. The observed adverse hematological characteristics of fish from polluted waters were probably due more to synergistic effects of the toxicants (Pb, Cd, Cu, Fe, Zn, Mn and oil and grease) rather than to the effects of each toxicant separately. (Mertz-PTT)
W91-06264

COMPARISON OF THE ROLES OF DIRECT ABSORPTION AND PHYTOPLANKTON INGESTION IN ACCUMULATION OF CHROMIUM BY SEA URCHIN LARVAE.
Otago Univ., Dunedin (New Zealand). Dept. of Microbiology.
P. J. Bremer, M. F. Barker, and M. W. Loutit.
Marine Environmental Research MERSDW, Vol. 30, No. 3, p 233-241, 1990. 3 tab, 17 ref.

Descriptors: *Bioaccumulation, *Chromium, *Echinoderms, *Food chains, *Path of pollutants, *Sea urchins, *Sublethal effects, Algae, Ecological effects, Lethal effects, Plankton, Water pollution, Water pollution effects.

For the purposes of ecological management it is important to understand the routes of metal accumulation by marine organisms, as well as their possible long-term lethal or sub-lethal effects. Chromium can have adverse effects on marine organisms so it is important to determine the long-term effects of its discharge to the environment. Larvae of the sea urchin Pseudechinus novaezealandiae were exposed to cells of the marine planktonic alga Dunaliella primolecta that had been cultured in the presence or absence of 6 microgram Cr/ml. Larvae exposed to the algal cells that had elevated Cr concentrations (2800 microgram Cr/g dry weight) accumulated up to 657 microgram Cr/g dry weight. The presence of the Cr had no adverse effect on either larval survival or growth rates. Additional cultures of larvae were exposed to Cr-free algal cells and Cr added from a stock Cr(III) solution. Again, the Cr had no detectable adverse effects; however, larvae accumulated Cr in significantly lower concentrations (71 microgram Cr/g dry weight) when the metal was added in solution, compared to when it was added in association with the algal cells. The results indicate that when larvae are exposed to Cr that is associated with algal cells they accumulate Cr to a greater degree than when they are exposed to Cr added independently of the algal cells. It is important to note that the ability of the larvae to accumulate high concentrations of Cr would not have been detected if the traditional LD50 type experiments had been performed. The work suggests that not only can algae act as a vehicle for entry of Cr to a marine food chain, but also that the transfer of Cr to the larvae is more efficient when the Cr is associated with a food source rather than in solution. (Mertz-PTT)
W91-06265

SECONDARY PRODUCTION OF CHIRONOMID COMMUNITIES IN INSECTICIDE-TREATED AND UNTREATED HEADWATER STREAMS.
Georgia Univ., Athens. Dept. of Entomology.
G. J. Lugthart, J. B. Wallace, and A. D. Huryn.
Freshwater Biology FWBLAB, Vol. 24, No. 3, p 417-427, December 1990. 2 fig, 3 tab, 41 ref. NSF Grants BSR83-16082, BSR87-18005, and BSR85-16497.

Descriptors: *Aquatic production, *Flies, *Insecticides, *Streams, *Water pollution effects, Appalachian Mountains, Biomass, Headwaters, Methoxychlor, Midges, Mountain streams.

Production of chironomid communities of three first order, Appalachian Mountain streams was estimated and the effects of an insecticide-induced disturbance on chironomid production was examined. Annual production of non-Tanypodinae chironomids in the streams during the first study year (no treatment) ranged from 1366 to 3636 mg/sq m, while production of Tanypodinae chironomids ranged from 48 to 116 mg/sq m. Production/biomass ratios ranged between 19 and 23 for non-Tanypodinae and from 6 to 7 for Tanypodinae chironomids. Application of the insecticide methoxychlor resulted in significantly lower chironomid densities and biomass in the treated stream relative to the pretreatment year and reference stream. Annual production of non-Tanypodinae (703 mg/sq m) and Tanypodinae (32 mg/sq m) chironomids in the treated stream decreased by 64% and 67%, respectively, compared with the pretreatment year. In contrast, production of non-Tanypodinae (2084 mg/sq m) increased by 34% and production of Tanypodinae (96 mg/sq m) by 57% in the reference stream. (Author's abstract)
W91-06268

RELATIONSHIPS BETWEEN THE PHYSICO-CHEMISTRY AND MACROINVERTEBRATES OF BRITISH UPLAND STREAMS: THE DEVELOPMENT OF MODELLING AND INDICATOR SYSTEMS FOR PREDICTING FAUNA AND DETECTING ACIDITY.
University Coll., Cardiff (Wales). School of Pure and Applied Biology.
For primary bibliographic entry see Field 5A.
W91-06269

NITRIFICATION AND NITRATE UPTAKE: LEACHING BALANCE IN A DECLINED FOREST ECOSYSTEM IN EASTERN FRANCE.
Centre de Pedologie Biologique, Vandoeuvre-les-Nancy (France).
For primary bibliographic entry see Field 5B.
W91-06308

NITRATE ACCUMULATION IN LEAVES OF VEGETATION OF A FORESTED ECOSYSTEM RECEIVING HIGH AMOUNTS OF ATMOSPHERIC AMMONIUM SULFATE.
Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
A. J. M. Stams, and I. J. L. Schipholt.
Plant and Soil PLSOA2, Vol. 125, No. 1, p 143-145, 1990. 1 tab, 12 ref.

Descriptors: *Acidic soils, *Air pollution effects, *Ammonification, *Farm wastes, *Forest ecosystems, *Forest soils, *Nitrates, *Water pollution sources, Absorption, Ammonia, Ammonium compounds, Leaves, Netherlands, Nitrification, Rhizosphere, Soil water, Trees, Vegetation effects.

Due to intensive livestock breeding, several forest ecosystems in the Netherlands receive high inputs of atmospheric ammonia and ammonium. Flux measurements in acid forest soil locations have shown that a major part of the atmospheric ammonium is oxidized to nitrate. At these locations the vegetation is not able to accumulate all the nitrate produced, and as a consequence the nitrate concentration in the soil water can reach values of up to 8 mM and a significant part of the nitrate is leached with the drainage water. Vegetation of an acid woodland, receiving an atmospheric ammoni-

um input of about 3 kmol (40 kg N) per hectare per year, was analyzed to determine the content of organic nitrogen, ammonium, and nitrate. A high nitrate content (50-320 micromol/g dry weight) was found in bird-cherry, blackberry, and bracken, whereas only low amounts (up to 2 micromol/g dry weight) of nitrate were present in mountain ash, hazel, and the two dominant tree species oak and birch. The impact of this nitrate uptake and nitrate accumulation on soil pH and autotrophic nitrification may include an extrusion of OH(-) or its equivalent, like HCO3(-), causing an increase of the pH of the rhizosphere. Autotrophic nitrifying bacteria may develop a microniche in this rhizosphere. (Fish-PTT)
W91-06309

ALUMINUM TOLERANCE IN TREES OF A TROPICAL CLOUD FOREST.
Instituto Venezolano de Investigaciones Cientificas, Caracas. Centro de Ecologia y Ciencias Ambientales.
G. Cuenca, R. Herrera, and E. Medina.
Plant and Soil PLSOA2, Vol. 125, No. 2, p 169-175, 1990. 1 fig, 2 tab, 36 ref.

Descriptors: *Acid rain effects, *Acidity, *Aluminum, *Bioaccumulation, *Rain forests, *Trees, *Tropical regions, Acidic soils, Acidic water, Resistance, Rhizosphere, Soil-water-plant relationships, Tolerance, Venezuela.

Acidity tolerance mechanisms in plants are receiving increased attention, especially in the industrialized countries where human activities are increasing the acidity of atmosphere, waters, and soils. The aluminum (Al) tolerance of several tree species was studied in a cloud forest in Northern Venezuela, growing on a very acid soil and rich in soluble Al. The Al-accumulator species (>1000 ppm in leaves) were compared to non-accumulator ones in relation to total Al concentration in xylem sap, pH, and Al concentration in vacuoles, and rhizosphere alkalinization capacity. The Al(+3) concentration in the soil solution and the xylem sap were also measured. The results show that in the Al-accumulator plant Richeria grandis, xylem sap was relatively rich in Al and about 35% of it was present in ionic form. In the non-accumulator plant studied (Guapira olfersiana) there was no Al detectable in xylem sap. The pH of vacuolar sap of several Al-accumulator species studied was very acidic and ranged between 2.6-4.8, but the presence of Al in vacuoles was not correlated with the acidity of the vacuolar sap. Both Al-accumulator and non-accumulator plants had the capacity to reduce acidity of the rhizosphere and increased the pH of the nutrient solution by one unit within the first 24 hours. Trees growing in natural, high acidity, high Al(+3) environment showed a series of tolerance mechanisms, such as deposition of Al in vacuoles, Al chelation and rhizosphere alkalinization. These partially ameliorate the toxic effects of this element, but they probably impose a high ecological cost in terms of photosynthate allocation and growth rate. (Author's abstract)
W91-06310

CHEMICAL COMPOSITION OF SOIL SOLUTIONS EXTRACTED FROM NEW ZEALAND BEECH FORESTS AND WEST GERMAN BEECH AND SPRUCE FORESTS.
Forest Research Inst., Christchurch (New Zealand). Forest and Wildland Ecosystems Div.
For primary bibliographic entry see Field 5B.
W91-06316

ACCELERATED NITROGEN INPUTS--A NEW PROBLEM OR A NEW PERSPECTIVE.
National Power, Leatherhead (England). Technology and Environmental Centre.
For primary bibliographic entry see Field 5B.
W91-06320

POLYCHLORINATED BIPHENYLS CONCENTRATION AND CYTOCHROME P-450E EXPRESSION IN WINTER FLOUNDER FROM CONTAMINATED ENVIRONMENTS.
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W91-06327

SEASONAL VARIATION OF MIXED-FUNCTION OXIDASE ACTIVITY IN A POPULATION OF YELLOW-LEGGED HERRING GULL: RELATIONSHIP TO SEXUAL CYCLE AND POLLUTANTS.
Siena Univ. (Italy). Dipt. di Biologia Ambientale.
C. Fossi, C. Leonzio, and S. Focardi.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 35-39, 1989. 2 fig, 10 ref.

Descriptors: *Animal metabolism, *Enzymes, *Gulls, *Mixed-function oxidase, *Oxidase, *Path of pollutants, *Population exposure, *Sexual cycle, *Toxicology, *Water pollution effects, Bioindicators, Chlorinated hydrocarbons, Cytochromes, Heavy metals, Seasonal variation, Venice Lagoon, Water birds.

Induction of the mixed-function oxidase (MFO) system has commonly been used as a biochemical marker of xenobiotic contamination in birds. The influence of intrinsic (e.g. sexual cycle) and extrinsic (xenobiotic) factors in determining the levels of MFO activity was investigated in a population of yellow-legged herring gull (Larus cachinnans). Aldrin epoxidase activity, 7-ethoxyresorufin dealkylation, NADPH-cytochrome c reductase, NADH-cytochrome c reductase, chlorinated hydrocarbon residues (hexachlorobenzene, Lindane, pp'DDE, polychlorinated biphenyls) and heavy-metal residues (Hg, Pb, Cd) were measured in three gulls collected in the Venice Lagoon, Italy, in different seasons in 1986 and 1987. Aldrin epoxidase undergoes marked seasonal variation, reaching a peak in the breeding season; on the other hand, 7-ethoxyresorufin dealkylation activity is more closely related to certain organochlorine residues (polychlorinated biphenyls). NADPH-cytochrome c reductase and NADH-cytochrome c reductase and NADH-ferricyanide reductase activities showed seasonal variation. These results suggest that seasonal variations in MFO activity, which may be related to the sexual cycle, need to be taken into account when considering biochemical effects of pollutants. (Author's abstract)
W91-06329

FISH AND MAMMALIAN LIVER CYTOSOLIC GLUTATHIONE S-TRANSFERASES: SUBSTRATE SPECIFICITIES AND IMMUNOLOGICAL COMPARISON.
Unit of Aquatic Biochemistry, Stirling (Scotland).
S. George, G. Buchanan, I. Nimmo, and J. Hayes.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 41-46, 1989. 1 fig, 2 tab, 15 ref.

Descriptors: *Animal physiology, *Detoxification, *Enzymes, *Fish physiology, *Glutathione S-transferases, *Mammals, *Toxicology, *Water pollution effects, Anadromous fish, Carcinogens, Cod, Comparison studies, Immunoassay, Proteins, Salmon.

The glutathione S-transferases (GST) are a multigene family of proteins which in mammals serve three complementary roles in detoxication: conjugation of many electrophilic compounds with glutathione to produce more soluble, excretable adducts; covalent binding of highly reactive electrophiles in a 'suicide' reaction, and; binding and intracellular transport of potentially toxic endobiotics for their metabolism. The substrate specificities of cytosolic GST activity were compared in three common marine fish and in anadromous and freshwater salmonids. Polyclonal antisera raised against purified rat and plaice GST subunits were used to investigate phylogenetic relationships between the mammalian and fish enzymes. Salmonids are extremely sensitive to hepatic neoplasia elicited by Aflatoxin B1 epoxide and produce the glucuronide, rather than the GSH, conjugate formed in rats, thus must have GSTs of different specificities. The presence of a Yf-type protein in the salmonids could also be related to the sensitivity to this mycotoxin-induced neoplasia, since expression of the Yf protein in rat liver is normally a characteristic of preneoplastic nodules. Several flatfish showed an extremely high incidence of PAH-induced hepatocarcinomas which may be due to increased sensitivity to cytochrome P-448 inducers or impaired detoxication abilities of the phase 2 enzyme systems. (Brunone-PTT)
W91-06330

EVALUATION OF BIOCHEMICAL RESPONSES TO ENVIRONMENTAL CONTAMINANTS IN FLATFISH FROM THE HVALER ARCHIPELAGO IN NORWAY.
Bergen Univ. (Norway). Dept. of Biochemistry.
A. Goksoyr, A.-M. Husoy, H. E. Larsen, J. Klungsoyr, and S. Wilhelmsen.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 51-55, 1989. 2 fig, 10 ref.

Descriptors: *Contamination, *Flatfish, *Hvaler Archipelago, *Norway, *Path of pollutants, *Toxicology, *Water pollution effects, Chlorinated hydrocarbons, Cytochromes, DDE, Ethoxy-resorufin O-deethylase, Fish physiology, Immunoassay, Polychlorinated biphenyls.

A degradation of the water quality and fish catches in the Hvaler Archipelago, along with increased incidences of fish diseases over the last decade have been reported by local fishermen. Flatfish caught at four different sites in the Hvaler Archipelago were analyzed for content of organochlorine contaminants (polychlorinated biphenyls (PCB), hexachlorobenzene (HCB), 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene, DDE, polychlorinated dibenzofurans (PCDF), and polychlorinated dibenzodioxins (PCDD) and polyaromatic hydrocarbons (PAH) in fillet and liver, and for cytochrome P-450-dependent ((ethoxyresorufin O-deethylase (EROD) and ethoxycoumarin O-deethylase (ECOD)) and conjugating (UDP-glucuronyltransferase) enzyme activities in lever S9-fractions. The liver samples were also analyzed immunochemically using Western blotting and an enzyme linked immunosorbent assay (ELISA) with antibodies against the beta-naphthoflavone-inducible cytochrome P-450 forms from cod, rainbow trout and perch. Sites close to contaminant effluents show elevated levels of the organochlorines HCB, DDE and PCB, but only background levels of the organochlorines PCDF/PCDD and PAH in sampled fish. Some of these sites showed highly induced EROD activities in the fish. Of the flatfish caught, only dab (Limanda limanda) showed a good correlation between EROD activity and immunochemical cross-reactivity. (Author's abstract)
W91-06331

INDUCTION OF CYTOCHROME P-450E (P-450IA1) BY 2,3,7,8-TETRACHLORODIBENZOFURAN (2,3,7,8-TCDF) IN THE MARINE FISH SCUP (STENOTOMUS CHRYSOPS).
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
M. E. Hahn, B. R. Woodin, and J. J. Stegeman.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 61-65, 1989. 1 fig, 1 tab, 12 ref. US PHS Grant ES04220.

Descriptors: *Cytochromes, *Fish, *Fish physiology, *Tetrachlorodibenzofurans, *Toxicology, *Water poliution effects, Dioxins, Enzymes, Ethoxy-resorufin O-deethylase, Mammals, Marine pollution, Polychlorinated biphenyls.

The halogenated aromatic hydrocarbons (chlorinated biphenyls, dibenzofurans, and dibenzo-p-dioxins) are known to be potent inducers of P-450IA1 in mammals. These compounds have been found in marine sediments and biota, but the ability of specific members of these groups of compounds to induce teleost P-450IA1 is, with limited exceptions, unknown. Fish were injected intraperitoneally with corn oil (1ml/kg), 3,4,3',4'-tetrachlorobiphenyl (3,4,3',4'-TCB) or 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF). P-450E-specific messenger RNA (P-450E mRNA) was measured using a trout P-450IA1 cDNA probe (pfP1 450-3'). The single dose (3.1 microg/kg; 10 nmol/kg) of 2,3,7,8-TCDF produced a strong, sustained induction of P-450E mRNA, protein, and ethoxyresorufin O-deethylase (EROD) activity in scup. Thus, this

compound and other chlorinated dibenzofurans and chlorinated dibenzo-p-dioxins may contribute to the induction of P-450IA1 observed in feral fish from contaminated environments. (Brunone-PTT)
W91-06332

INDUCTION OF THE HEPATIC MICROSOMAL MIXED-FUNCTION OXYGENASE (MFO) SYSTEM OF ALLIGATOR MISSISSIPPIENSIS BY 3-METHYLCHOLANTHRENE (3-MC).
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
C. S. E. Jewell, L. E. Cummings, M. J. J. Ronis, and G. W. Winston.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 73-79, 1989. 3 tab, 15 ref.

Descriptors: *Alligators, *Enzymes, *Liver, *Louisiana, *Methylcholanthrenes, *Microsomes, *Mixed-function oxygenase, *Oxygenase, *Toxicology, *Water pollution effects, Animal physiology, Antibodies, Cytochromes, Ethoxy-resorufin O-deethylase, Hydrocarbons, Hydroxylases.

The American alligator of south Louisiana is threatened by increasing impact from the more than 200 chemical industries that discharge into its habitats. Intraperitoneal pretreatment of alligators with 3-methylcholanthrene (3-MC) resulted in an increase ($P<0.001$) in cytochrome P-450 specific content, a bathochromic shift in the absorption maxima of reduced, CO-liganded microsomes (448 nm), and a 12-fold increase in benzo(a)pyrene hydroxylase activity. The turnover number (units, nmol P-450) of aminopyrine N-demethylase and 7-ethoxyxoumarin O-deethylase were unaffected by 3-MC treatment. 3-MC treatment resulted in a significant ($P<0.001$) increase in turnover numbers of the O-dealkylations of methoxy-substituted resorufins, ethoxy-substituted resorufins, and benzyloxy-substituted resorufins. The turnover number of pentoxyresorufin O-dealkylase was unaltered by 3-MC treatment. Western blots showed that control alligator microsomes contain a protein band of lower molecular weight than either rat cytochrome P-450c (P-450IA1) or P-450d (P-450IA2), recognized by antibodies to both P-450c and P-450d. 3-MC treatment induced a second protein band in alligator microsomes of the same molecular weight as rat P-450d, recognized by antibodies to rat cytochrome P-450d. Alligator mixed-function oxidase (MFO) system responds to 3-MC like mammals, i.e. induction in P-450 content, increases in specific MFO activities and the apparent expression of different P-450 isoenzymes. (Author's abstract)
W91-06334

PURIFICATION AND PROPERTIES OF HEPATO-PANCREAS AND GREEN GLAND CYTOSOLIC GLUTATHIONE S-TRANSFERASES OF THE RED SWAMP CRAYFISH, PROCAMBARUS CLARKII.
Louisiana State Univ., Baton Rouge. Dept. of Biochemistry.
C. S. Jewell, R. F. Lee, and G. W. Winston.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 81-85, 1989. 2 tab, 9 ref.

Descriptors: *Animal metabolism, *Crayfish, *Glutathione S-transferases, *Green gland, *Hepatopancreas, *Path of pollutants, *Toxicology, *Water pollution effects, Electrophoresis, Enzymes, Invertebrates, Proteins, Purification, Separation techniques.

Both vertebrates and invertebrates contain multiple forms of glutathione S-transferase (GST) which are capable of detoxifying structurally diverse xenobiotic substrates. Cytosolic fractions from hepatopancreas and green gland of the red swamp crayfish, Procambarus clarkii, contained high GST activity, 5.4 +/-0.6 and 4.2 +/-0.2 micromol/min/mg protein, respectively as measured with 1-chloro-2,4-dinitrobenzene (CDNB). The GSTs have been purified to electrophoretic homogeneity from 105,000 x g supernatant of hepato-pancreas and green gland homogenates by employing Sephadex-G-200, DEAE-Sephacel and chromatofocusing. Two isoenzymes were purified from hepato-pancreas; one which eluted at pH 5.2 with a specific activity of 86.8 micromol/min/mg, and one at pH 5.1 with a specific activity of 58.3 micromol/min/mg. Purification of GST from green gland resulted in two isoenzymes which eluted at pH 5.1 and 4.6 and had specific activities of 38.0 and 164 micromol/min/mg. Preliminary data suggest that all of the isoenzymes are dimers with subunit molecular weights of 22,000 to 23,000 Da. The purified GST were most active in the conjugation of CDNB and showed little or no activity towards other common substrates. Cytosolic activities with p-nitrophenyl acetate and p-nitrophenyl trimethylacetate were higher than could be accounted for by the activity of the purified isoenzymes. These data suggest the presence of isoenzymes in cytosol that might have gone undetected using a purification scheme which employs CDNB as the electrophilic substrate. (Author's abstract)
W91-06335

BLEACHED KRAFT PULPMILL EFFLUENTS AND TCDD: EFFECTS ON BIOTRANSFORMATION AND TESTOSTERONE STATUS OF MATURE MALE RAINBOW TROUT (SALMO GAIRDNERI).
Kuopio Univ. (Finland). Dept. of Physiology.
P. Lindstrom-Seppa, and A. Oikari.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 99-103, 1989. 2 tab, 11 ref.

Descriptors: *Biotransformation, *Dioxins, *Path of pollutants, *Pulp wastes, *Toxicology, *Trout, *Water pollution effects, Effluents, Fish physiology, Kidneys, Liver, Oxygenase, Population studies, Species composition, Steroids, Toxicity.

Fish populations are affected by pulpmill effluents in species composition changes. The effect of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), given intraperitoneally) was investigated alone and together with bleached kraft pulpmill effluents (BKME) on fish biotransformation reactions and testosterone levels in mature male rainbow trout (Salmo gairdneri Richardson). The results show extremely high induction in liver and kidney monooxygenase (PMSO) activities in three weeks caused by TCDD alone or TCDD together with BKME. BKME alone did not cause significant effects. 7-Pentoxyresorufin O-dealkylase activity, previously shown to be an indicator of phenobarbital-type induction, was highly inducible by TCDD in fish. Plasma testosterone levels, although decreased in another subacute exposure to BKME showed only slight changes due to TCDD and TCDD + BKME. The possible interference between cellular PMSO systems and regulation of steroid status of fish species as a functional basis of reproductive toxicity due to BKME and its components should be examined in more detail. (Author's abstract)
W91-06337

CHARACTERIZATION OF BNF-INDUCIBLE CYTOCHROME P-450IA1 IN CULTURES OF RAINBOW TROUT LIVER CELLS.
West Virginia Univ., Morgantown. Dept. of Biochemistry.
M. R. Miller, D. E. Hinton, and J. B. Blair.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 105-108, 1989. 2 fig, 1 ref. National Cancer Institute Grant CA45131.

Descriptors: *Animal metabolism, *Beta-naphthaflavone, *Carcinogenicity, *Cytochromes, *Liver, *Mutagenicity, *Toxicology, *Trout, *Water pollution effects, Cell culture, Enzymes, Ethoxy-resorufin O-deethylase, Immunoassay, Model studies.

Isolated rainbow trout hepatocytes can provide a model system for characterizing the carcinogenic and toxic effects of xenobiotics. For these studies, cytochrome PA450-IA1, the beta-naphthoflavone (BNF)-inducible isozyme, which is fundamental for the phase I metabolism of many xenobiotics, must be characterized. Ethoxyresorufin O-deethylase (EROD) activity and immunoreactivity of P-450IA1 were measured in isolated trout liver cells maintained in culture for at least 3 days. Liver cells prepared from trout pretreated with BNF exhibited readily detectable EROD activity, which rapidly declined when cells were placed in culture, with a half life of about 15 hours. Addition of BNF, dexamethasone, glucagon, insulin or gamma-aminolevulinic acid alone or in combinations neither prevented this decline nor induced EROD activity in isolated cells prepared from control animals. Acetaminophen in the culture media helped maintain EROD activity, immunoreactive P-450 and total cytochrome P-450 in hepatocytes prepared from BNF-treated trout. Light and electron microscopy revealed that concentrations of acetaminophen which were most effective in maintaining EROD produced distinctive toxic effects to the cells. The mechanism(s) by which acetaminophen influences EROD activity is not yet known; however, these findings establish one way to manipulate P-450IA1 in cultured trout hepatocytes. (Author's abstract)
W91-06338

HYDROCARBON CONTENT AND MICROSOMAL BPH AND REDUCTASE ACTIVITY IN MUSSEL, MYTILUS SP., FROM THE VENICE AREA, NORTH-EAST ITALY.
Istituto di Biologia del Mare, Venice (Italy).
C. Nasci, G. Campesan, V. U. Fossato, F. Dolci, and A. Menetto.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 109-112, 1989. 1 fig, 1 tab, 9 ref.

Descriptors: *Enzymes, *Hydrocarbons, *Italy, *Microsomes, *Reductases, *Sea mussels, *Toxicology, *Water pollution effects, Animal metabolism, Cytochromes, Digestive gland, Population studies, Seasonal variation, Tissue analysis, Venice.

During 1988, wild mussels were collected bimonthly from two stations having different pollution loads. The first station was located close to the city of Venice and the second was located offshore in the Gulf of Venice, north-east Italy. Composite samples of digestive glands were analyzed for their aliphatic and aromatic hydrocarbon content and for microsomal benzo(a)pyrene hydroxylase (BPH), NADH-ferricyanide reductase and NADH-cytochrome c reductase and NADPH-cytochrome c reductase activities. Results indicated significant differences between the two stations in digestive gland hydrocarbon content, while enzymatic activity remained at equal levels. No significant correlations were found between biochemical parameters and hydrocarbon concentrations in digestive glands. Seasonal variations both in microsomal enzymatic activity and in hydrocarbon content of digestive glands likely mask the possible relationships between biochemical and chemical parameters. (Author's abstract)
W91-06339

INDUCTION OF XENOBIOTIC METABOLIZING ENZYME ACTIVITIES IN PRIMARY CULTURE OF RAINBOW TROUT HEPATOCYTES.
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
M. Pesonen, A. Goksoyr, and T. Andersson.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 113-116, 1989. 1 fig, 1 tab, 8 ref.

Descriptors: *Biotransformation, *Cell culture, *Enzymes, *Metabolism, *Toxicology, *Trout, *Water pollution effects, Animal metabolism, Bioassay, Cytochromes, Ethoxy-resorufin O-deethylase, Hydrocarbons, Immunoassay, Model studies, Toxicity.

Xenobiotic metabolizing enzymes biotransform various lipophilic, foreign compounds (xenobiotics) to water-soluble products. Fish liver cytochrome P-450 enzymes are induced by polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCBs). Environmental pollutants such as petroleum products and pulp bleach plant effluents are also potent inducers of fish cytochrome P-450. Rainbow trout hepatocytes in primary monolayer culture maintained several important cell functions and enzyme activities involved in xenobiotic metabolism. Furthermore, cytochrome P-450-dependent 7-ethoxyresorufin O-deethylase activity and the amount of the major polycyclic

aromatic hydrocarbons (PAH)-inducible form of cytochrome P-450 (measured by enzyme-linked immunosorbent assay (ELISA) using an antibody towards cod P-450c) increased after treatment of cells with beta-naphthoflavone or 2,3,7,8-tetrachlorodibenzo-p-dioxin. Cultured trout hepatocytes seems to be a promising in vitro model which may serve as a screening test for toxic constituents in industrial effluents or for studies on regulation of xenobiotic metabolism by exogenous and endogenous factors. (Author's abstract)
W91-06340

EXPRESSION OF ORTHOLOGUES TO RAT P-450IA1 AND IIB1 IN SEA-BIRDS FROM THE IRISH SEA 1987-88: EVIDENCE FOR ENVIRONMENTAL INDUCTION.
Karolinska Inst., Stockholm (Sweden). Dept. of Physiological Chemistry.
M. J. J. Ronis, J. Borlakoglu, C. H. Walker, T. Hansson, and J. J. Stegeman.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 123-130, 1989. 3 tab, 14 ref.

Descriptors: *Cytochromes, *Environmental effects, *Irish Sea, *Toxicology, *Water birds, *Water pollution effects, Cross-reactivity, Ethoxyresorufin O-deethylase, Gas chromatography, Mass spectroscopy, Microsomes, Monoclonal antibodies, Orthologs, Oxygenase, Polychlorinated biphenyls, Western blotting.

Five species of fish-eating seabirds (cormorant, razorbill, puffin, guillemot and shag) were collected from the Saltee Isles and the Isle of May between the years 1978 and 1988. Liver microsomes were assayed for monoooxygenase activity using the cyclodienes aldrin and HCE as substrates. For birds killed in 1988, microsomes were also assayed for 7-ethoxyresorufin O-deethylase activity. Tissue subsamples were stored in a tissue bank at minus 70 C and analyzed for polychlorinated biphenyls (PCBs) by capillary gas chromatography (GC) and GC-mass spectroscopy. Microsomes were probed in Western blots with polyclonal antibodies against rat P-450IA1 (P-450c) and rat P-450IIB1 (P-450b) and also with a monoclonal antibody towards P-450E from the scup, the P-450IA1 orthologue in this fish species. Samples from 1978 to 1980 showed a higher degree of expression of this P-450IA1 orthologue than those collected more recently. This result correlated with the distribution of PCB residues in the samples, suggesting a degree of environmental induction. Only weak cross-reactivity was seen with antibodies against rat P-450IIB1, suggesting that no phenobarbitol-type induction was occurring in PCB-exposed bird species. (Author's abstract)
W91-06342

DIFFERENTIAL EXPRESSION OF MULTIPLE FORMS OF CYTOCHROME P-450 IN VERTEBRATES: ANTIBODIES TO PURIFIED RAT CYTOCHROME P-450S AS MOLECULAR PROBES FOR THE EVOLUTION OF P-450 GENE FAMILIES I AND II.
Karolinska Inst., Stockholm (Sweden). Dept. of Physiological Chemistry.
M. J. J. Ronis, T. Andersson, T. Hansson, and C. H. Walker.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 131-135, 1989. 2 tab, 14 ref. Swedish Medical Research Council Grant 5949.

Descriptors: *Bioassay, *Cytochromes, *Rats, *Toxicology, *Vertebrates, *Water pollution effects, Animal metabolism, Cross-reactivity, Enzymes, Gene family, Genetics, Monoclonal antibodies, Oxygenase, Pollutants.

Cytochrome P-450-dependent monooxygenases are responsible for the phase I metabolism of a variety of liposoluble xenobiotics including pesticides, pollutants and carcinogens in aquatic organisms. Polyclonal antibodies against rat cytochrome P-450c (P-450IA1), P-450d (P-450IA2), P-450b (P-450IIB1), P-450h (P-450IIC11) and P-450j (P-450IIE1), were used to probe liver microsomes prepared from species in an number of vertebrate groups. Liver microsomes were prepaed from hagfish (Myxine glutinosa), dogfish shark (Squalus acanthus), perch (Perca fluvitalis), spectacled cayman (Caimen crocodylus), alligator (Alligator mississippiensis), cormorant (Phalacrocorax carbo), shag (P. aristotelis), razorbill (Alca torda), guillemot (Uria aalge), puffin (Fratercula arctica), fulmar (Fulmarus glacialis), Manx shearwater (Puffinus puffinus) and compared to male Sprague/Dawley rats (Rattus rattus), the most common laboratory animal used in cytochrome P-450 studies. Cross-reactivity in Western blots was used to examine the appearance of cytochrome P-450 isozymes structurally related to the rat forms in lower vertebrate groups and to provide information of the evolution of cytochrome P-450 gene families I and II and their regulation in lower vertebrates. The P-450 gene family I is well represented in all vertebrate groups while gene family II, which is extremely complex in mammals, consists of a few isozymes, probably more structurally related to rat IIC isozymes forms than to members of other rat P-450II subfamilies. These results explain the ready inducibility of microsomal monooxygenases by polycyclic aromatic hydrocarbons and other inducers of P-450 gene family I in lower vertebrate groups and the relative lack of inducibility seen with phenobarbitol, non-coplanar PCBs and other inducers of P-450 gene family IIB in those species. (Brunone-PTT)
W91-06343

COMPARATIVE METABOLISM OF BENZO(A)PYRENE AND (-) BENZO(A)PYRENE-7,8-DIHYDRODIOL BY HEPATOCYTES ISOLATED FROM TWO SPECIES OF BOTTOM-DWELLING FISH.
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
A. R. Steward, J. Zaleski, R. C. Gupta, and H. C. Sikka.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 137-140, 1989. 1 fig, 7 ref. US EPA Grant R81379910.

Descriptors: *Animal metabolism, *Benzopyrene, *Carcinogenicity, *Liver, *Polycyclic aromatic hydrocarbons, *Toxicology, *Water pollution effects, Bullhead, Carp, Comparison studies, DNA, Fish physiology, Hydrocarbons.

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental contaminants frequently found at high levels in sediments (both marine and freshwater) exposed to industrial/urban discharges and/or oil seepage, and have been identified in fish captured from contaminated locations. A freshwater benthic fish, the brown bullhead (Ictalurus nebulosus), when found in PAH-contaminated waterways, is reported to display a high incidence of hepatic tumors which are not found in bullheads captured from clean locations. To elucidate the biochemical bases of species differences in susceptibility to hepatotumorigenesis induced by PAHs, such as benzo(a)pyrene (BP), the metabolism of tritiated BP and its proximate carcinogenic metabolite (-)BP-7,8-dihydrodiol (BP-7,8-diol) was investigated in two species of fish: brown bullhead and mirror carp (Cyprinus carpio) which is not known to be susceptible. Freshly isolated hepatocytes prepared from both species efficiently converted both BP and BP-7,8-diol (the proximate carcinogenic metabolite of BP) to glutathione conjugates, glucuronides and sulfates and polyhydroxylated compounds. Nevertheless, carp hepatocytes (which metabolized both BP and BP-7,8-diol about two times faster than did bullhead hepatocytes) produced larger amounts of DNA adducts from both substrates, suggesting the formation by carp liver of significantly larger amounts of reactive intermediates that bind to DNA. The apparently greater susceptibility of brown bullheads to PAH-induced carcinogenesis thus awaits further clarification. (Brunone-PTT)
W91-06344

FISH METALLOTHIONEINS: MOLECULAR CLONING STUDIES AND INDUCTION IN CULTURED CELLS.
Stirling Univ. (Scotland). Inst. of Aquaculture.
S. George, M. Leaver, N. Frerichs, and D. Burgess.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 173-177, 1989. 2 fig, 12 ref.

Descriptors: *Animal metabolism, *Cadmium, *Fish physiology, *Metallothioneins, *Path of pollutants, *Toxicology, *Water pollution effects, *Zinc, Amino acids, DNA, Detoxification, Plaice, RNA, Trace metals, Trout.

Metallothioneins specifically bind heavy metal ions such as Ag, Cd, Cu, Hg, and Zn by clusters of thiolate bonds and are thought to function both in the normal metabolism and homeostasis of Cu and Zn and detoxication of Cd and Hg. A complementary DNA for plaice metallothionein (MT) was cloned and the sequence for the first 45 amino acid residues was deduced. The sequence of plaice MT was exactly homologous to that of winter flounder MT. Studies of MT induction by cadmium and zinc in a rainbow trout cell line showed that both metals were strong inducers of the proteins in contrast to previous reports which have shown little induction of MT messenger RNA by cadmium. The contrasting results obtained imply differential stabilities of MT messenger RNA after exposure to the different metals and probably also differences in stability of cadmium-thioneins and zinc-thioneins. Translation control or differential messenger RNA and MT stabilities are inferred. (Brunone-PTT)
W91-06347

INDUCTION OF METALLOTHIONEIN BY CADMIUM IN BLUESTRIPED GRUNT (HAEMULON SCIURUS).
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
For primary bibliographic entry see Field 5A.
W91-06349

ALTERATION OF CALCIUM TRANSPORT AS A MECHANISM OF CELL INJURY INDUCED BY HGCL2 IN SEA URCHIN EGGS.
Centre Scientifique de Monaco, Monte Carlo.
D. Allemand, P. Walter, P. Delmas, and D. De Renzis.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 227-230, 1989. 2 fig, 9 ref.

Descriptors: *Calcium, *Cell injury, *Echinoderms, *Heavy metals, *Ion transport, *Mercury, *Path of pollutants, *Toxicity, *Toxicology, *Water pollution effects, Animal metabolism, Animal pathology, Bioaccumulation, Bioassay, Cytology, Eggs.

In spite of a large number of pathological studies on the toxic action of heavy metals, their mechanism of cytotoxic action remains poorly understood. By using sea urchin eggs as a biological model, the effects of heavy metals on ionic parameters were investigated. Specific alteration of calcium homeostasis can be the trigger for cell death produced by a wide variety of phenomena. The effect of HgCl2 on intracellular calcium regulation was tested. The results show that HgCl2 increases calcium(2+) uptake by voltage-dependent calcium channels and as a consequence produces an accumulation of calcium within the cells. This accumulation is cyanide-sensitive, suggesting the involvement of mitochondria. These results have been used to develop an ecotoxicity test for field biological monitoring. The measurement of calcium content provides a useful index of the state of health of marine organisms. (Author's abstract)
W91-06355

METABOLIC/PHYSIOLOGICAL BASIS OF GENOTYPE-DEPENDENT MORTALITY DURING COPPER EXPOSURE IN MYTILUS EDULIS.
Plymouth Marine Lab. (England).
A. J. S. Hawkins, J. Rusin, B. L. Bayne, and A. J. Day.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 253-257, 1989. 2 fig, 1 tab, 9 ref.

Descriptors: *Animal metabolism, *Animal physiology, *Copper, *Genetics, *Heavy metals, *Mortality, *Mussels, *Sea mussels, *Toxicology,

*Water pollution effects, Adaptation, Electrophoresis, Filtration rate, Genotype, Heterozygosity, Proteins, Regression analysis, Survival.

Fitness consequences of interrelations between genotype, protein metabolism and physiology were examined in 88 individual Mytilus edulis exposed to 150 ppb dissolved copper until death. Electromorphs heterozygous for the enzyme phosphoglucose isomerase (Pgi) survived longest, suggesting an adaptive nature of specific Pgi genotypes. Time to death varied between 4 and 28 days, and did not correlate with tissue concentrations of copper at death. Instead, multiple regressions confirm separate positive effects both of filtration rate and protein turnover upon rate of copper accumulation, as well as separate negative effects of these same two processes upon time to death. Rate of filtration was the primary physiological determinant of survival. Faster breakdown and renewal of proteins also accompanied reduced survival during stress induced by exposure to high levels of dissolved copper. (Author's abstract)
W91-06357

MERCURY INHIBITS THE TRANSPORT OF D-GLUCOSE BY THE INTESTINAL BRUSH BORDER MEMBRANE VESICLES OF FISH.
Rutgers - The State Univ., Piscataway, NJ. Nelson Biological Lab.
A. Farmanfarmaian, K. A. Pugliese, and L.-Z. Sun.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 247-251, 1989. 1 fig, 2 tab, 16 ref.

Descriptors: *Bioaccumulation, *Glucose, *Ion transport, *Mercury, *Path of pollutants, *Toxicology, *Water pollution effects, Absorption, Animal metabolism, Electrochemical gradient, Enzymes, Fish food, Food chains, Intestinal brush borders, Nutrient transport.

Mercury compounds (HgCl2 and CH3HgCl) in polluted coastal waters accumulate in the food chain. When the food is digested in the gut of invertebrates and fish Hg(2+) and CH3Hg(+) bind to the brush border membrane of the enterocytes facing the lumen of the intestine. Under in vivo or in vitro tissue incubation the bound mercury inhibits the absorption of nutrients such as amino acids and sugars. In order to differentiate the membrane effect from intracellular metabolic effects brush border membrane vesicles were prepared and purified. These vesicles showed 6-fold to 7-fold enrichment for alkaline phosphatase, leucine aminopeptidase, and maltase (all membrane enzymes that face the lumen). Little or no enrichment was found for sodium ion-potassium ion ATPase considered to be on the basolateral membranes of the enterocyte. The vesicles transported glucose when provided with a sodium ion electrochemical gradient. This transport was abolished in the absence of a sodium ion electrochemical gradient or in the presence of Phlorizin. At 0.1 mM glucose, HgCl2 (20 ppm) abolished 90% of this transport and CH3HgCl (20 ppm) abolished 30% of the transport. At 1 mM glucose the inhibition values were 70% and 32%, respectively. In the case of HgCl2, inhibition of transport is significant even at 5 ppm. These findings confirm that mercury compounds can interact with intestinal brush border membranes to inhibit nutrient absorption in fish feeding in polluted waters. (Author's abstract)
W91-06359

OXYRADICAL GENERATION AND REDOX CYCLING MECHANISMS IN DIGESTIVE GLAND MICROSOMES OF THE COMMON MUSSEL, MYTILUS EDULIS L.
Santiago Univ. (Spain). Dept. of Biochemistry.
P. G. Martinez, S. O'Hara, G. W. Winston, and D. R. Livingstone.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 271-274, 1989. 2 tab, 12 ref. NATO Grant RG86/0534.

Descriptors: *Animal metabolism, *Digestive gland, *Microsomes, *Oxygen requirements, *Sea mussels, *Toxicology, *Water pollution effects, Bivalves, Enzymes, Hydroxyl ions, Ion transport, Pollutants, Radicals, Toxicity.

The normal fate of molecular oxygen in animals is tetravalent reduction to water. Mechanisms of xenobiotic-stimulated oxyradical generation were investigated in digestive gland microsomes using menadione (MD) and nitrofurantoin (NF) as model redox cycling compounds, and iron/EDTA as a promotor of the Haber-Weiss reaction. Hydroxyl radicals were detected by oxidation of the scavenging agents alpha-keto-gamma-methiobutyric acid and sodium benzoate. MD and NF both stimulated hydroxyl radical production from NADH or NADPH. NADPH-dependent hydroxyl ion production became limited at lower concentrations of xenobiotic (MD), or stimulation was less marked (NF), than for NADH. In the case of MD, the existence of MD, the existence of an NADPH-dependent microsomal antioxidant enzyme, DT-diaphorase, limiting the formation of the MD semiquinone is indicated. Inhibitor studies indicated the involvement of superoxide anion radical, O2(-) (and redox cycling) and hydrogen peroxide in the formation of hydroxyl ions. The results support the possibility of enhanced oxyradical generation as a mechanism of pollution-induced toxicity in mollusks. (Author's abstract)
W91-06362

INTERACTIONS OF XENOBIOTICS WITH REPRODUCTIVE ENDOCRINE FUNCTIONS IN A PROTOGYNOUS TELEOST, MONOPTERUS ALBUS.
Manipur Univ., Imphal (India). Dept. of Life Sciences.
H. Singh.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 285-289, 1989. 1 fig, 4 ref. Government of India Grant 21(50)84-STP-I.

Descriptors: *Fish pathology, *Fish physiology, *Pollutants, *Reproduction, *Sublethal effects, *Toxicology, *Water pollution effects, 3-Methylcholanthrene, Animal metabolism, Cadmium, Histology, Malathion.

The effects of sublethal concentrations of three xenobiotics, cadmium, malathion and 3-methylcholanthrene (3-MC) on pituitary-thyroid-liver-ovary axis were studied in a protogynous teleost, Monopterus albus. After one week of exposure, the gonadosomatic index (GSI) of pollutant-exposed fish was significantly reduced but the hepatosomatic index (HSI) of some fish was higher than the control. Disintegration of the histological structure of thyroid, liver and ovary was a common feature of exposed fish; however, the degree of structural alteration was different in different tissues for different pollutants. Plasma levels of both testosterone and estradiol and also phosphoprotein (vitellogenin) were significantly reduced following exposure to cadmium, malathion, and 3-MC. Thyroid tissue was differently affected by these treatments. Cadmium and 3-MC have significantly elevated triiodothyronine (T3) and thyroxine (T4) levels in both plasma and thyroid; however, the T3/T4 ratio was high only in thyroid tissue. In comparison, malathion has significantly increased T3 and T4 levels and the T3/T4 ratio in both plasma and thyroid tissue. In in vivo as well as in vitro studies, exposure to cadmium and 3-MC resulted in significant elevation of thyroid peroxidase activity. These results provide evidence that these pollutants interfere with the endocrine system, resulting in hormonal imbalance which may be due to an impairment of either the synthesis or the secretion of these hormones, and thereby significantly affect the reproductive physiology of this species. (Author's abstract)
W91-06364

ASSESSMENT OF THE GENOTOXICITY OF PRODUCED WATER DISCHARGES ASSOCIATED WITH OIL AND GAS PRODUCTION USING A FISH EMBRYO AND LARVAL TEST.
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
C. B. Daniels, and J. C. Means.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 303-307, 1989. 1 fig, 1 tab, 2 ref.

Descriptors: *Brine disposal, *Embryonic growth stage, *Fish larvae, *Genotoxicity, *Marine environment, *Natural gas, *Oil industry, *Toxicology, *Water pollution effects, Aquatic animals, Brackish water, Chromosomal aberrations, Gulf of Mexico, Marine fisheries, Oil spills, Spawning.

Widespread discharge of produced waters (PW), water released to the surface from permeable petroleum-bearing sedimentary rocks during offshore production of oil and gas, into brackish and marine waters of the northwest Gulf of Mexico, which serve as spawning grounds for many commercially important species of fish, has raised concern over the potential impact that these complex mixtures may have on aquatic life. In order to assess the impact of the PW discharges on spawning populations of aquatic organisms, chromosome aberration analysis was performed on Cyprinodon variegatus embryos 4 to 7 days old, which were exposed directly to varying dilutions of PW collected at Pass Fourchon and Timbalier Island for a period of 5 days. Metaphase chromosomes were scored (percentage aberration per 100 metaphase) for aberrations at a magnification of 1000 times. When compared to the control treatment, higher levels of chromosomal aberrations were observed for treatments (2 and 4% PW) in which embryos were exposed to PW from Pass Fourchon or Timbalier Island. A maximum frequency of 13% was found to occur at the highest test concentration (4% PW), with most of these expressed as breaks (chromatid and chromosome). In contrast, exposure to water from the enclosed canal at Fourchon resulted in the formation of chromosome breaks and changes in ploidy. The data presented suggest the need for continued research on the effects of chronic operational discharge of formation waters into estuarine environments upon aquatic species. (Author's abstract)
W91-06365

LASER DESORPTION-IONIZATION FT-ICR MASS SPECTROMETRY: DNA-ADDUCT BASES, NUCLEOSIDES AND NUCLEOTIDES.
Pittsburgh Univ., PA.
C. S. Giam, T. L. Holiday, J. L. Williams, R. R. Weller, and J. A. Mayernik.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 309-312, 1989. 1 tab, 16 ref. NIH Grant RO1-CA45131-01.

Descriptors: *Analytical methods, *Carcinogenicity, *DNA, *Mass spectrometry, *Nucleosides, *Nucleotides, *Pollutant identification, *Toxicology, *Water analysis, *Water pollution effects, Aquatic animals, Carcinogens, Ionization, Lasers, Molecular weight.

DNA-adduct formation is of particular importance in the evaluation of aquatic exposure to carcinogens, since it may be the critical initial event that ultimately results in adverse effects; such manifestations may not be observed until months or years following exposure. DNA-adduct formation was investigated following exposure of experimental animals to certain carcinogens, e.g. diethylnitrosamine and ethylcarbamate. Bases such as 7-ethylguanine, O6-ethylguanine and 1,N6-ethenoadenine, from DNA adducts can be monitored with HPLC and characterized by mass spectrometry. Nucleosides, nucleotides and other high molecular weight compounds from DNA adducts often have very low vapor pressures and are thermally unstable. Such compounds cannot be directly analyzed by conventional mass spectrometry. Using Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometry with IR laser desorption/ionization, molecular or pseudomolecular ions of these compounds can be obtained fairly easily. (Author's abstract)
W91-06366

PRE-EXPOSURE TO 3-METHYLCHOLANTHRENE INCREASES BENZO(A)PYRENE ADDUCTS ON DNA OF BLUEGILL SUNFISH.
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. F. McCarthy, D. N. Jacobson, L. R. Shugart, and B. D. Jimenez.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 323-326, 1989. 2 fig, 12 ref. US

Department of Energy Contract DE-AC05-84OR21400.

Descriptors: *3-Methylcholanthrene, *Benzopyrene, *Bioassay, *Bioindicators, *DNA, *Genotoxicity, *Path of pollutants, *Sunfish, *Toxicology, *Water pollution effects, Animal metabolism, Enzymes, Liver, Mixed-function oxidase, Population exposure, Toxicity.

Increasing attention has been given to measurements of molecular and biochemical events in exposed organisms (biomarkers) that indicate exposure to, and effects of, toxicants. Pre-induction of the hepatic mixed-function oxidase (MFO) system was investigated in bluegill sunfish, Lepomis macrochiris, injected intraperitoneally with 3-methylcholanthrene (3-MC) 5 days prior to injection with benzo(a)pyrene (BaP). Another group of fish were injected only with BaP. On days 0,1,3 and 6 after BaP injection, liver microsomes were assayed for several MFO parameters, and BaP adducts in liver were quantified. Pre-exposure to 3-MC induced MFO activity to much higher levels, but did not protect the DNA from formation of adducts of BaP. DNA from the liver of pre-exposed fish had twice as many BaP adducts. Multiple contaminants appear to act synergistically on the formation of DNA adducts, in spite of the higher MFO activity. These results illustrate three points critical to understanding the effect of exposure to genotoxic agents, and to interpreting molecular and biochemical parameters of biomarkers of exposure and effects in animals: induction of the MFO system is not necessarily a benign enhancement of detoxication capacity; assumptions of linear dose-response relationships for formation of DNA adducts may not be valid for many environmental exposures, and; the dose and method of exposure to genotoxic agents have significant impacts on the rate, extent and reversibility of damage to the DNA of fish. (Author's abstract)
W91-06368

USING THE DNA ALKALINE UNWINDING ASSAY TO DETECT DNA DAMAGE IN LABORATORY AND ENVIRONMENTALLY EXPOSED CELLS AND TISSUES.
Science Applications International Corp., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W91-06369

MORPHOLOGICAL CHANGES IN TROUT HEPATOCYTES EXPOSED TO ACETAMINOPHEN.
West Virginia Univ., Morgantown. Dept. of Biochemistry.
For primary bibliographic entry see Field 5A.
W91-06370

MEASUREMENT OF DISEASE SUSCEPTIBILITY IN DAB, LIMANDA LIMANDA L., FOLLOWING LONG-TERM EXPOSURE TO CONTAMINATED SEDIMENTS: PRELIMINARY STUDIES.
Ministry of Agriculture, Fisheries and Food, Weymouth (England). Fish Diseases Lab.
D. Bucke, P. F. Dixon, S. W. Feist, and R. J. Law.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 363-367, 1989. 2 fig, 8 ref.

Descriptors: *Fish diseases, *Flatfish, *Sediment contamination, *Synergistic effects, *Toxicology, *Water pollution effects, Contaminants, Immunoassay, Mortality, Path of pollutants, Population exposure, Sediment chemistry, Sludge.

Dab, Limanda limanda, were given long term exposure (>3 months) on highly contaminated harbor sludge and less-contaminated sediment, and to compare the immune response and uptakes of contaminants between the two groups. Following exposure to the sediments, mortalities and clinical signs of disease were recorded. The dab were then challenged individually by intraperitoneal injection with 0.1 ml of a 1% suspension of inactivated Vibrio anguillarum. The fish were examined for clinical signs of disease. Blood and samples of organs, including brain, were taken for histological examination. The remainder of these fish (and all fish dying during the experiments) were frozen for contaminant uptake analysis. Clinical and histopathological changes were observed in both groups of fish with skin ulcerations and gill hyperplasia, showing a slightly higher prevalence in the fish exposed to contaminated harbor sludge. Quantification of the immune response was by agglutination assay and an enzyme-linked immunoassay. Fish maintained on the contaminated harbor sludge have a significantly lower mean antibody titers than those on the reference sediment. However, because the fish on the contaminated sediments were still able to produce a marked response to the antigen, in biological terms, no difference may exist in the susceptibility to disease between the two groups. (Author's abstract)
W91-06371

DIETHYLNITROSAMINE (DEN)-INDUCED DEGENERATIVE, PROLIFERATIVE AND NEOPLASTIC LESIONS IN THE LIVER OF THE MEDAKA (ORYZIAS LATIPES) FOLLOWING SHORT-TERM EXPOSURE.
Johns Hopkins Univ., Baltimore, MD. Dept. of Pathology.
T. E. Bunton.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 369-374, 1989. 6 fig, 5 ref. US Army Biomedical Research and Development Laboratory DAMD17-88-C-8029; NIH RR00130.

Descriptors: *Carcinogenicity, *Diethylnitrosamine, *Fish pathology, *Liver, *Medaka, *Toxicity, *Toxicology, *Water pollution effects, Bioassay, Fish physiology, Human diseases, Necrosis, Population exposure, Public health.

The tissue responses of fish to hepatocarcinogens is an area of intense interest from both an environmental standpoint and in the interest of carcinogenicity and toxicity testing as a tool to assess human cancer risk. To test the effects of short-term exposure of diethylnitrosamine (DEN) on the liver of the medaka, groups of medaka were exposed for 48 hours to relatively low (100 mg/L), medium (200 mg/L), and high levels (400 mg/L) of DEN and sequential sacrifices made over a 6 month post-exposure period. Many of the lesions seen have been reported in studies using lower level, long-term exposures and included hepatocellular necrosis, spongiosis hepatitis, foci of cellular alteration and benign and malignant biliary and hepatocellular neoplasms. Higher exposure levels led to increased severity and incidence of many of the lesions seen within the time frame of the study. (Author's abstract)
W91-06372

PREVALENCE OF LEUKEMIA IN HEMOLYMPH OF SOFT-SHELL CLAMS, MYA ARENARIA, IN DORCHESTER BAY, BOSTON HARBOR.
Tufts Univ., Boston, MA. School of Veterinary Medicine.
A. C. Craig, R. P. E. Yanong, and C. L. Reinisch.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 383-387, 1989. 2 fig, 18 ref. NIH CA 44307.

Descriptors: *Animal diseases, *Baseline studies, *Boston Harbor, *Carcinogenicity, *Clams, *Hemolymph, *Leukemia, *Outfall sewers, *Toxicology, *Wastewater disposal, *Water pollution effects, Bivalves, Gills, Histology, Population exposure, Seasonal distribution, Statistical analysis.

As part of a multidisciplinary study gathering baseline data on conditions in Boston Harbor prior to modification of a combined sewer outfall at Savin Hill, four sites in Dorchester Bay, Boston Harbor were selected to gather baseline data on the prevalence of leukemia in soft-shell clams, Mya arenaria. Prevalence studies were conducted from September 1986 to December 1987 using two techniques to evaluate hemolymph: indirect immunoperoxidase staining using monoclonal antibodies specific for leukemic cells of Mya, and; Feulgen-picromethyl blue staining. Tissue samples were also obtained from some clams for histopathological examination. The results show that no statistically significant prevalence of leukemia exists in any of the four sites studied. Also, no seasonal pattern exists for the prevalence of disease. The prevalence of the leukemia in Boston Harbor is similar to natural background levels; however, gill inflammation and hyperplasia are elevated. (Brunone-PTT)
W91-06373

COMPARATIVE STUDY OF THE DIFFERENTIAL BLOOD CELL COUNTS OF WINTER FLOUNDER (PSEUDOPLEURONECTES AMERICANUS) COLLECTED IN NEW ENGLAND.
Science Applications International Corp., Narragansett, RI.
T. G. Daniels, and G. R. Gardner.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 389-392, 1989. 1 tab, 6 ref. US EPA Contract No. 68-03-3529; NCI Grant No. MW-75-930029.

Descriptors: *Blood, *Cell counting, *Cytology, *Fish pathology, *Flounders, *New England, *Sediment contamination, *Toxicology, Boston Harbor, Comparison studies, Connecticut, Distribution patterns, Narragansett Bay, Path of pollutants, Sediment chemistry, Urban watersheds, Water pollution effects.

Major alterations in the distribution of peripheral blood cells were observed among winter flounder (Pseudopleuronectes americanus) from Martha's Vineyard (MV), East Cape Cod Bay (ECCB), Fox Island (FI) (Narragansett Bay), Central Long Island Sound (CLIS), Gaspee Point (GP) (Narragansett Bay), Black Rock Harbor (BRH) (Bridgeport, Connecticut), New Bedford Harbor (NBH) and Quincy Bay (QB) (Boston Harbor). Collection locations ranged from relatively uncontaminated offshore (MV) and nearshore (ECCB) sites to the more contaminated estuarine (FI, CLIS) and urban embayments (GP, BRH, NBH, QB). Differential diagnosis demonstrated a shift in lymphocyte counts from 28% (MV) to 54% (QB) that increased with the incidence of liver lesions in relation to known and suspected levels of sediment chemical contamination. A significant change in the ratio of circulating immature to mature erythrocytes was observed in flounder collected from Boston Harbor. Immature erythrocytes comprised 18% of the total erythrocyte population of fish from QB in comparison to 6% observed in flounder from ECCB. (Author's abstract)
W91-06374

COMPARISON OF BOTH NEOPLASTIC AND NON-NEOPLASTIC DISORDERS IN WINTER FLOUNDER (PSEUDOPLEURONECTES AMERICANUS) FROM EIGHT AREAS IN NEW ENGLAND.
Environmental Protection Agency, Narragansett, RI. Environmental Research Lab.
G. R. Gardner, R. J. Pruell, and L. C. Folmar.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 393-397, 1989. 1 fig, 1 tab, 9 ref.

Descriptors: *Animal diseases, *Cape Cod, *Carcinogenicity, *Fish pathology, *Flounders, *Massachusetts, *New England, *Path of pollutants, *Sediment contamination, *Toxicology, *Water pollution effects, Distribution patterns, Hydrocarbons, Lesions, Liver, Marine environment, Proteins, Sediment chemistry.

Distribution patterns of liver disease observed in winter flounder indigenous to the northeastern USA indicated that hepatocytic neoplasms were absent in populations from uncontaminated offshore areas and endemic in populations from moderately to highly contaminated inshore areas. Liver neoplasms in winter flounder collected from eight different locations ranged from 0% in animals collected offshore from Cape Cod to 32% in the nearshore area of New Bedford, Massachusetts. Similarly, an array of other hepatic lesions ranged from 9% in Martha's Vineyard to 79% in Boston Harbor. Proliferate lesions in endocrine, exocrine, respiratory, sensory, excretory and digestive organs and alteration of plasma protein were also characteristic of winter flounder populations resid-

ing in the nearshore environment. The concentrations of polycyclic aromatic hydrocarbons, polychlorinated biphenyls, other organic compounds, and trace metals associated with marine sediment were elevated in urban embayments as compared with offshore locations. Degree of sediment chemical contamination and disease suggest a causal interrelationship. (Author's abstract)
W91-06375

SOME EFFECTS OF SEDIMENT-BORNE CONTAMINANTS ON DEVELOPMENT AND CYTOMORPHOLOGY OF TELEOST EYE-LENS EPITHELIAL CELLS AND THEIR DERIVATIVES.
Virginia Inst. of Marine Science, Gloucester Point.
W. J. Hargis, and D. E. Zwerner.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 399-405, 1989. 2 fig, 17 ref.

Descriptors: *Croakers, *Cytology, *Fish pathology, *Fish physiology, *Hydrocarbons, *Path of pollutants, *Sediment contamination, *Toxicology, *Virginia, *Water pollution effects, *Weakfish, Aberrations, Bioassay, Bright-field microscopy, Cataracts, Sediment chemistry, Toxicity.

Lens cataracts were found in three sciaenids, Atlantc croaker (Micropogonias undulatus), weakfish (Cynoscion regalis) and spot (Leiostomus xanthurus) in the severely polluted Elizabeth River, Virginia, and induced by in vitro exposure of spot to polycyclic aromatic hydrocarbon-contaminated Elizabeth River sediments. An unusual organ, the living (epithelial and new fiber cells) and nonliving (older fiber cells and the capsule) components of eye lenses are products of a single cell type. Many lens abnormalities result from developmental, metabolic or morphological aberrances induced in epithelial cells or new fiber cells. Cataracts of most types observed in our samples are such lesions. Developmental and micromorphological modifications in lens epithelial cells, their cell progeny (the fiber cells) and acellular products (the capsule) related to cataract production from intoxication were examined by bright-field microscopy. Cataractous feral and laboratory-exposed finfishes were employed, with reference or control specimens for comparison. Studies of cataractogenesis in teleost eyes should yield valuable information on cellular effects of pollution-related intoxication. Further, the whole lens, the lens epithelial layer and individual lens cells are promising subjects for in vivo and in vitro studies of toxicity and environmental bioassay. (Author's abstract)
W91-06376

IN VIVO MICROSCOPY OF LIVER MICROVASCULATURE IN RAINBOW TROUT (ONCORHYNCHUS MYKISS).
California Univ., Davis. School of Veterinary Medicine.
For primary bibliographic entry see Field 5A.
W91-06377

ENVIRONMENTAL CONTAMINATION AND CANCER IN FISH.
California Univ., Davis. School of Veterinary Medicine.
D. E. Hinton.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 411-416, 1989. 1 fig, 1 tab, 27 ref. US PHS Grant ES 04699; NIH Grant CA 45131.

Descriptors: *Benthic fauna, *Bioassay, *Carcinogenicity, *Contamination, *Fish pathology, *Liver, *Toxicology, *Water pollution effects, Aging, Environmental effects, Enzymes, Mammals, Tumor formation, Urban watersheds.

Field investigations of liver neoplasia in feral fishes indicate that tumor-bearing animals are of advanced age, have bottom-dwelling life styles, and reside in polluted areas near urban centers. Laboratory investigations have shown that neoplasia in fish liver, unlike that of its mammalian counterparts, is a multistage process involving initiation, promotion, and progression. Based on intervals of time between initiation and tumor formation in laboratory exposures, tumor laden livers in multi-year feral fishes could have been the result of exposure to initiating carcinogen(s) as an embryo, larva, or adult. Promotion of carcinogenesis likely results by exposure of previously initiated fish to substances within sediments or food. While linkages between fish liver neoplasia and carcinogens in the water table, sediment or food has been sought, the presence or absence of tumors may be related more to the concentration of promoter substances at specific environmental sites. Given the rapid capacity of small aquarium fishes for tumor development, correlated field and laboratory studies to assess the roles of environmental contaminants as promoters of carcinogenesis are possible within a reasonable time frame. Enzyme altered foci should be included in field studies where presence would indicate initiation and volume would reflect promotion of carcinogenesis. (Author's abstract)
W91-06378

CELLULAR EFFECTS OF ENVIRONMENTAL CONTAMINATION IN FISH FROM THE RIVER ELBE AND THE NORTH SEA.
Biologische Anstalt Helgoland (Germany, F.R.)
A. Koehler.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 417-424, 1989. 2 fig, 2 tab, 9 ref.

Descriptors: *Cytology, *Environmental effects, *Fish pathology, *North Sea, *Path of pollutants, *Toxicology, *Water pollution effects, Bioaccumulation, Detoxification, Elbe Estuary, Liver, Lysosomes, Wadden Sea.

Fish were sampled along a pollution gradient from the Elbe estuary towards the northern part of the Wadden Sea coast and the Eider estuary (reference areas). Livers of different age groups of flounder (0, I, II, III) were investigated in order to relate the degree of tissue lesions to the exposure time or lifespan the fish inhabits the differently contaminated areas. The severity of pathological liver changes corresponds to the accumulation of contaminants and differs significantly with prolonged residence at the investigated sites. Liver ultrastructure revealed evidence of severe perturbations of the intracellular organization to cellular responses indicating the initiation of detoxification processes and normal compartmentation of hepatocytes along the pollution gradient investigated. Based on the studies of normal liver structure and its pathological phenomena indicating a key role of the lysosomal system, the lysosomal stability test (N-acetyl-hexosaminidase) was applied in order to relate tissue and cellular pathology to cytochemical indices reflecting the biochemistry of the injured tissue. Preliminary results revealed a highly significant negative correlation between the stability of the lysosomal membrane to the degree of liver lesions. Furthermore, the initial results obtained from the mouth of the Elbe estuary and a northern reference area in the Wadden Sea inferred significant differences with respect to lysosomal stability. (Author's abstract)
W91-06379

CELLULAR ALTERATIONS PRECEDING NEOPLASIA IN PSEUDOPLEURONECTES AMERICANUS FROM BOSTON HARBOR.
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
M. J. Moore, R. Smolowitz, and J. J. Stegeman.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 425-429, 1989. 2 fig, 11 ref. US PHS Grant RO1-CA44306; MIT/WHOI Joint Program, Sea Grant New Initiative Grant RB-94-PD.

Descriptors: *Boston Harbor, *Carcinogenicity, *Cytology, *Fish pathology, *Flounders, *Toxicology, *Water pollution effects, Aggregation, Biliary systems, Contamination, Liver, Macrophages, Path of pollutants, Population exposure.

Hepatic changes that include hepatocellular and cholangiocellular neoplasia are prevalent in adult winter flounder from Boston Harbor. Early pathogenic changes in fish of 100 to 300 mm included biliary proliferation, abnormal vacuolation of biliary pre-ductular epithelial cells and macrophage aggregation. The identification of biliary pre-ductular epithelial cells was based on nuclear morphology, numerous cellular junctions with adjacent hepatocyte apices, lack of contiguity with sinusoidal structures and central location in the hepatic tubule. Fish longer than 300 mm had progressively worsening pan-tubular changes in cholangiocytes and hepatocytes which culminated in grossly visible foci of vacuolation and associated neoplasia. Flounder from less contaminated sites showed occasional macrophage aggregations, but no other changes. These results indicate that initial vacuolar change in Boston flounder occurs predominantly in pre-ductular cells, which may be stem cells, extending later to fill entire hepatic tubules and intrahepatic portions of the biliary system. (Author's abstract)
W91-06380

EFFECT OF POLYCYCLIC AROMATIC HYDROCARBONS ON IMMUNE RESPONSES IN FISH: CHANGE IN MELANOMACROPHAGE CENTERS IN FLOUNDER (PSEUDOPLEURONECTES AMERICANUS) EXPOSED TO HYDROCARBON-CONTAMINATED SEDIMENTS.
Department of Fisheries and Oceans, St. John's (Newfoundland). Science Branch.
J. F. Payne, and L. F. Fancey.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 431-435, 1989. 1 fig, 1 tab, 10 ref.

Descriptors: *Fish pathology, *Fish physiology, *Flounders, *Hydrocarbons, *Immune responses, *Polycyclic aromatic hydrocarbons, *Sediment contamination, *Toxicology, *Water pollution effects, Animal diseases, Human diseases, Path of pollutants, Pollutants, Population exposure, Sediment chemistry, Toxicity.

Considerable debate on whether the concentrations of xenobiotics commonly found in the environment are high enough to affect immune functions in humans or other animal populations continues. Only a limited number of immunotoxicity studies have been carried out with fish. Melanomacrophage centers (MMC) represent the primitive analogs of lymph nodes in mammals and are believed to be an integral component of the cellular immune system in fish. The potential for change in MMC was investigated in a long-term study with winter flounder exposed to sediments contaminated with a petroleum source of polycyclic aromatic hydrocarbons (PAH) for approximately four months. Numbers of MMC were reduced in liver tissues of fish exposed to total PAH concentrations in the 25 to 50 microg/g (ppm) range and higher. Results support the hypothesis that PAH concentrations in heavily polluted harbors (and similar) may be sufficiently high to affect immune responses in fish. (Author's abstract)
W91-06381

HISTOPATHOLOGICAL ASSESSMENT OF NEUROTOXIC INJURY IN MAMMALS: POSSIBLE APPLICATIONS FOR SIMILAR STUDIES IN FISH.
Imperial Chemical Industries Ltd., Alderley Park (England). Central Toxicology Lab.
For primary bibliographic entry see Field 5A.
W91-06382

CELLULAR DISTRIBUTION OF CYTOCHROME P-450E IN WINTER FLOUNDER LIVER WITH DEGENERATIVE AND NEOPLASTIC DISEASE.
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
R. M. Smolowitz, M. J. Moore, and J. J. Stegeman.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 441-446, 1989. 1 fig, 1 tab, 7 ref. NIH Grant ES-04220.

Descriptors: *Animal diseases, *Boston Harbor, *Cytochromes, *Cytology, *Fish pathology, *Flounders, *Toxicology, *Water pollution effects, Antibodies, Carcinogenicity, Histology, Hydrocarbons, Immunoassay, Liver, Path of pollutants.

A characteristic hepatic pathology is highly prevalent in winter flounder (Pseudopleuronectes americanus) from severely polluted regions of Boston Harbor. The cellular expression of a cytochrome P-450E analog in normal and diseased winter flounder was evaluated using immunohistochemical analysis with Mab 1-12-3, a monoclonal antibody specific for P-450E. Cytochrome P-450E (P-450IA1) is the polynuclear aromatic hydrocarbon (PAH)-inducible and polychlorinated biphenyl-inducible form of P-450 from scup (Stenotomus chrysops). Mab 1-12-3 was first applied to formalin-fixed, paraffin-embedded sections of control and 3,3,4,4-tetrachlorobiphenyl-treat scup liver using an indirect peroxidase staining technique to visualize antibody binding. The results demonstrated specific positive staining of hepatocytes, bile and pancreatic duct epithelium and endothelium for P-450E, confirming utility of Mab 1-12-3 in analysis of fixed tissue. Subsequent analysis of archival winter flounder liver also demonstrated positive staining of hepatocytes. No staining of abnormally vacuolated cells was present in any of the fish; however, nodules of such cells occasionally contained islands of intensely staining cells of unknown origin. The cellular distribution of P-450E indicates a metabolic heterogeneity which could influence the responses of different cell types to subsequent or continued exposure to PAH or other hepatotoxins. (Author's abstract)
W91-06383

ROLE OF THE RED GLAND IN MERCENARIA MERCENARIA IN DETOXIFICATION.
Environmental Protection Agency, Narragansett, RI.
For primary bibliographic entry see Field 5B.
W91-06384

USE OF BIOINDICATORS FOR ASSESSING THE EFFECTS OF POLLUTANT STRESS ON FISH.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06385

EFFECT OF SELENIUM ON THE UPTAKE OF CADMIUM BY THE MARINE MACROALGA HYMENOMONAS (CRICOSPHAERA) ELONGATA.
Institut National de la Sante et de la Recherche Medicale, Paris (France).
F. Boisson, M. Gnassia-Barelli, J. Chiaverin, and M. Romeo.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 465-469, 1989. 2 fig, 2 tab, 9 ref.

Descriptors: *Algal physiology, *Antagonistic effects, *Cadmium, *Marine algae, *Path of pollutants, *Selenium, *Toxicity, *Toxicology, *Water pollution effects, Algal growth, Experimental design, Limiting nutrients, Nutrient concentrations, Selenate, Selenite, Trace metals.

In the marine environment, selenium exists in several states of oxidation: (IV) selenite and (VI selenate. Selenite is more biologically reactive than selenate. Selenium may interfere with cadmium toxicity in marine organisms. The uptake of cadmium by the marine macroalga Hymenomonas elongata was previously shown to be dependent on duration, cadmium concentration in the medium, growth phase and light. The effect of selenium (as selenite) on cadmium uptake was evaluated. The variables considered in the two-level factorial experimental design were cadmium concentration (0.5 and 2 microM), Se(4+) (0.5 and 2 microM) and duration (1 and 25 hours). The studied response was the cadmium concentration in the algae. When selenium is present, the uptake of cadmium significantly increased with duration. A significant positive correlation exists between selenium in the medium and contact time. (Brunone-PTT)
W91-06386

DETECTION OF MAJOR STRESS PROTEIN USING A PEPTIDE ANTIBODY.
Maryland Univ. at Baltimore. Dept. of Biological Sciences.
B. P. Bradley, and J. B. Ward.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 471-475, 1989. 1 fig, 11 ref.

Descriptors: *Analytical methods, *Bioassay, *Bioindicators, *Immunoassay, *Peptides, *Proteins, *Stress, *Toxicology, *Water pollution effects, Amphipods, Antibodies, Bacteria, Environmental effects, Evolution, Molecular weight, Radiography, Reflectance scanning, Temperature effects.

Living cells respond to environmental contamination and to stress in general by synthesizing what are known as stress proteins. The synthesis of a major stress protein (hsp70) is induced by extremes of a wide variety of environmental variables, both physical and chemical. This protein of approximately 70,000 Da is a widespread heat shock protein and is present in various isomorphs in many species. Nevertheless, this protein is highly conserved among organisms from bacteria to man. The production of hsp70 in a natural population of amphipods (Gammarus sp.) varied with ambient temperature. Protein extracts were probed on immunoblots using a polyclonal antibody made against a highly conserved peptide of hsp70. Relative protein production was estimated using reflectance scanning. These results, and others, using immunoblots, autoradiography, and immunosorbence assays suggest that the stress protein response may be a useful quantitative and qualitative environmental indicator. (Author's abstract)
W91-06387

RELATIONSHIP BETWEEN PCB CONCENTRATIONS AND REPRODUCTION IN MUSSELS MYTILUS EDULIS.
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
H. Hummel, J. P. UitOudeGroeneveld, J. Nieuwenhuize, J. M. van Liere, and R. H. Bogaards.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 489-493, 1989. 2 fig, 13 ref.

Descriptors: *Mussels, *Polychlorinated biphenyls, *Spawning, *The Netherlands, *Toxicology, *Water pollution effects, Bioaccumulation, Bivalves, Ecotoxicology, Estuaries, Fats, Gonads, Oosterschelde, Path of pollutants, Tissue analysis, Westerschelde.

Changes in the concentrations of PCBs and fats were followed in mussels (Mytilus edulis), transferred vice versa between a polluted estuary (Westerschelde) and a relatively low-pollution sea-arm (Oosterschelde). Concentrations in the mantle, which contains the gonads, were determined separately from the rest of the body. The fat content of the mantle increased 1.5 to 2 times during the observation period (autumn, winter) and remained constant in the rest of the body. Polychlorinated biphenyls (PCBs) in mussels transferred from the polluted to the less polluted area were not eliminated. In the mussels transferred to the polluted area the increase of the PCB content was 2-fold to 3-fold over a period of three months. PCBs in the mantle, and therefore in the gonads, can amount to more than 40% of the total PCB load in a mussel. During the spawning of gametes, a substantial proportion of the PCBs may be shed. (Author's abstract)
W91-06390

EFFECTS OF AROCLOR 1254 AND CADMIUM ON REPRODUCTIVE ENDOCRINE FUNCTION AND OVARIAN GROWTH IN ATLANTIC CROAKER.
Texas Univ., Port Aransas. Marine Science Inst.
P. Thomas.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 499-503, 1989. 1 tab, 6 ref. EPA Grant R-812797 and US PHS Grant R0-ES04214.

Descriptors: *Cadmium, *Croakers, *Fish physiology, *Polychlorinated biphenyls, *Toxicology, *Water pollution effects, Ecotoxicology, Endocrine function, Gonadotropin, Heavy metals, Organic compounds, Spawning, Toxicity, Vitellogenesis.

The reproductive endocrine effects of sublethal exposure to a PCB mixture (Aroclor 1254), and cadmium in female Atlantic croaker (Micropogonias undulatus) were investigated by feeding the fish Aloclor 1254 (0.5 mg/100 g body weight/day) for 17 days, or exposing them to 1 mg cadmium/L seawater (30 ppt S) for 40 days during the period of ovarian recrudescence. Both cadmium and the PCB disrupted reproduction, but they exerted opposite effects on reproductive endocrine function and ovarian growth. PCB treatment impaired ovarian growth which was accompanied by a significant decline in vitellogenesis as assessed by a decrease in plasma estradiol levels. In addition, a decrease in spontaneous secretion of gonadotropin (GTH) occurred in vitro by pituitaries from PCB-treated fish. In contrast, exposure to cadmium accelerated ovarian growth and elevated plasma estradiol concentrations, suggesting a stimulation of vitellogenesis. In addition, spontaneous secretion of GTH increased markedly from the pituitaries of cadmium-exposed fish in vitro. The results show that chemicals can disrupt reproductive processes in teleosts both by inhibiting and stimulating the activity of the hypothalamus-pituitary-gonadal-liver axis. (Author's abstract)
W91-06392

PLANAR CHLORINATED HYDROCARBONS (PCHS) IN COLONIAL FISH-EATING WATERBIRD EGGS FROM THE GREAT LAKES.
Michigan State Univ., East Lansing. Dept. of Pediatrics/Human Development.
D. E. Tillitt, G. T. Ankley, and J. P. Giesy.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 505-508, 1989. 2 fig, 8 ref.

Descriptors: *Cormorants, *Eggs, *Great Lakes, *Hydrocarbons, *Path of pollutants, *Terns, *Toxicology, *Water birds, *Water pollution effects, Animal physiology, Bioassay, Cytochromes, Dioxins, Ecological effects, Ecotoxicology, Enzymes, Organic compounds, Polychlorinated biphenyls, Polychlorinated dibenzofurans, Reproduction, Toxicity.

Reproductive impairment of double-crested cormorants (Phalacrocorax auritis) and Caspian terns (Hydroprogne caspia) has recently been observed in the Great Lakes of North America. Planar polychlorinated chlorinated hydrocarbons (PCHs), which include polychlorinated biophenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs), are believed to be at least partially responsible for the increased incidence of teratogenesis and embryonic mortality. The potency of the PCH mixtures were assessed in egg extracts from these colonial waterbirds. The relative potency of the egg extracts was assessed by their ability to induce cytochrome P-450-dependent ethoxyresorufin O-deethylase (EROD) in H4IIE rat hepatoma cells. The magnitude of the response was compared with EROD induction in cell cultures by a standard 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The TCDD-equivalents derived from this bioassay concur with residue analysis and biological data, in that the highest TCDD-equivalents were found in waterbird egg composites from areas with greater PCH concentrations and more severe reproductive effects. Significant concentrations of PCHs were detected in all sites tested; the range of TCDD-equivalents in the waterbird eggs was 49 to 415 pg/g, uncorrected for extraction efficiencies. The evidence is strong for at least a partial role of PCHs as causal agents in the reproductive impairment of fish-eating waterbirds from the Great Lakes of North America. (Author's abstract)
W91-06393

DOSE/RESPONSE STUDY OF 2,3,7,8-TCDD IN THE RAINBOW TROUT (SALMO GAIRDNERI).
Utrecht Rijksuniversiteit (Netherlands). Environmental Toxicology Section.
For primary bibliographic entry see Field 5A.
W91-06394

INTERACTIVE EFFECTS OF POLLUTANTS AT THE TOXICOKINETIC LEVEL--IMPLICATIONS FOR THE MARINE ENVIRONMENT.
Reading Univ. (England). Dept. of Physiology and Biochemistry.
C. H. Walker, and G. O. Johnston.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 521-525, 1989. 2 tab, 12 ref.

Descriptors: *Kinetics, *Marine environment, *Physiological ecology, *Toxicity, *Toxicology, *Water pollution effects, Biochemistry, Carcinogenicity, Cytochromes, Enzymes, Fish, Fish physiology, Insecticides, Malathion, Organic compounds, Polycyclic aromatic hydrocarbons, Water birds.

In some polluted areas, marine organisms are exposed to a wide selection of organic pollutants, with an enormous number of possible interactive effects. The study of interactive effects of pollutants from the toxicokinetic point of view should aid the identification of combinations of compounds likely to cause environmental problems. The toxicity of a pollutant may be increased if other pollutants (a) inhibit its detoxification or (b) increase its activation. For example, large increases in the toxicity of insecticides may occur because of the inhibition of esterases and monooxygenases. Induction of cytochrome P-450 forms can greatly increase the toxicity of the insecticide malathion, due to a decisive switch in metabolism from detoxification to activation. Induction of cytochrome P-450s of family IA (P448s) in fish and birds is caused by various pollutants, and may lead to the enhanced activation of carcinogens in marine organisms. Elevated levels of this bype of enzyme in fish from polluted areas may be the sonsequence of induction. The possibility that locally-high incidences of neoplasms in fish could be due to PAHs and other organic pollutants hase frequently been suggested. Snvironmental induction of cytochromes of the P448 type is likely to increase the carcinogenic effects of PAHs by certain other pollutants. Recent studies on sea birds from British and Irish coastal waters have shown the existence of relatively-high levels of an ortholog of cytochrome P450IA1 in individual birds; this is associated with relatively high levels of PCB. This also suggests environmental induction of the P-448 type that is known to b induced in other birds by various agents, and which can readily activate PAHs and other carcinogens. The possiblility that PAHs may be rapidly activated by induced P-450s in sea birds from areas affected by oil pollution deserves serious consideration. Sea birds readily acquire high tissue levels of hydrocarbons in such polluted areas. (Brunone-PTT)
W91-06395

TREATED MUNICIPAL WASTEWATERS: EFFECTS ON DEVELOPMENT AND GROWTH OF FISHES.
New Jersey Medical School, Newark. Dept. of Anatomy.
P. Weis, J. S. Weis, and A. Greenberg.
Marine Environmental Research MERSDW, Vol. 28, No. 1/4, p 527-532, 1989. 2 fig, 5 ref. NOAA Grant No. NA85AA-D-SG084, Project R/E-10.

Descriptors: *Fish growth, *Flounders, *Mummichog, *Municipal wastewater, *Striped bass, *Toxicity, *Toxicology, *Water pollution effects, Bioassay, Ecotoxicology, Embryonic growth stage, Estuaries, Fish larvae, Fish physiology, Gas chromatography, Hudson-Raritan Estuary, Organic compounds, Water pollution sources.

Effluents from municipal wastewater treatment facilities supply >98% of point-source pollutants and 13% of total freshwater input to the Hudson-Raritan Estuary. The effects of chlorinated effluents on the sensitive early life stages of three species of fish common to this estuary were studied. One source of effluents is a publicly owned treatment facility, which receives about half of its input from industrial sources. Batch-to-batch variability in the chemistry of this effluent was reflected in biological impact. Embryos of the mummichog (Fundulus heteroclitus) might survive >50% or <10% effluent. Effects of moderately toxic batches included cardiovascular and skeletal defects, depression of heart rate, and poor hatch. Embryos of the winter flounder (Pseudopleuronectes americanus) had skeletal defects and decreased hatch and larval growth. Growth of juveniles, as represented by a fin regeneration assay, was depressed at concentrations 4= 10% by all five batches assayed with striped bass (Morone saxatilis), three of five batches tested with mummichog, and by the one batch tested with flounder. Analysis of the effluent indicated relatively low levels of heavy metals. A toxic batch had 8 times the total chlorocarbon level of an innocuous batch. The gas chromatography/ion chromatogram of the toxic batch had higher levels and greater diversity of pollutants. (Author's abstract)
W91-06396

EFFECT OF CLIMATE CHANGE ON SEA LEVEL RISE AND THE IMPLICATIONS FOR WORLD AGRICULTURE.
J. G. Titus.
Horticultural Science, Vol. 25, No. 12, p 1567-1572, December 1990. 4 fig, 37 ref.

Descriptors: *Agriculture, *Climatic changes, *Global warming, *Greenhouse effect, *Sea level, Air pollution effects, Beach erosion, Coastal engineering, Coastal environment, Coastal waters, Deltas, Estuaries, Flooding, Saline water intrusion, Shore protection, Wetlands.

An overview of the causes, effects, and responses to sea level rise has been compiled, drawing on previous studies of the impacts on coastal cities, ocean beach resorts, wetlands, and water supplies. The global warming from the greenhouse effect could raise sea level approximately 1 m in the next century by expanding ocean water, melting mountain glaciers, and causing ice sheets in Greenland to melt or slide into the oceans. Such a rise would inundate coastal wetlands and lowlands, erode beaches, increase the risk of flooding, and increase the salinity of estuaries, aquifers, and wetlands. The possible responses to a sea level rise are coastal defense (building seawalls, adapting to the advancing sea, or raising the land), increasing the amount of fresh water flowing into the estuary during droughts, and decreasing competitive withdrawals. All of the major impacts of sea level rise would have effects on agriculture, particularly in deltaic nations. A substantial fraction of agricultural lands could be inundated or eroded; increased flooding could threaten crops; and saltwater intrusion could threaten the availability of irrigation water. Although these impacts could be important in particular areas, on a worldwide basis they will probably be relatively unimportant compared with the other impacts of global warming; however, particular crops grown in low-lying areas may be disproportionately affected. (Fish-PTT)
W91-06416

LONG-TERM ENVIRONMENTAL EFFECTS ASSOCIATED WITH LAND APPLICATION OF MUNICIPAL SLUDGES: A REVIEW.
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5E.
W91-06452

MODELLING THE EFFECTS OF ACID DEPOSITION IN A PEATY CATCHMENT IN FINLAND.
Water and Environment Research Inst., Helsinki (Finland).
A. Lepisto.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 455-465, 4 fig, 3 tab, 23 ref.

Descriptors: *Acid rain, *Acid rain effects, *Acidic water, *Data analysis, *Finland, *Hydrologic data, *Hydrologic models, *Model studies, *Peat, *Streamflow forecasting, *Wetlands, Aluminum, Calcium, Diatoms, Hydrogen ion concentration, Lake Matojarvi, Liuhapuro catchment, MAGIC model, Magnesium, Organic acids, Paleolimnology, Radiometric dating.

Peatlands are ubiquitous in northern landscapes and decomposition of their plant remains produces complex, colored organic acids that acidify their waters and those of the streams and lakes into which they drain. Long-term changes in surface water quality has been studied in an organically rich, acid Liuhapuro catchment in eastern Finland. The MAGIC (Model Acidification of Groundwater In Catchments) model is based on the assumption that certain chemical processes (anion retention, cation exchange, primary mineral weathering, aluminum dissolution, and CO2 solubility) in catchment soils are likely keys to the responses of surface water quality to acidic deposition. Calcium and magnesium concentrations have increased 60-70% from the preacidification values estimated by the model. Because of the high load of organic acids in the Liuhapuro stream, it was acid before atmospheric pollution; a decline of pH from 4.6 to 4.4 was estimated despite the buffering of the system by organic compounds. The risk for an increasing leaching of aluminum is obvious, and this has occurred already to some extent. Paleolimnological data for the nearby humic Lake Matojarvi sediments (diatom analysis and 210Pb dating) provide independent evidence of decreasing pH in waters of the area during the past 200 years or so. (See also W91-06461) (Author's abstract)
W91-06506

FOREST HYDROLOGY AND WATERSHED MANAGEMENT.
For primary bibliographic entry see Field 4C.
W91-06510

ACIDITY AND ALKALINITY OF RESERVOIR WATER IN THE SIERRA NEVADA, CALIFORNIA.
California Univ., Berkeley. Dept. of Plant and Soil Biology.
For primary bibliographic entry see Field 5B.
W91-06512

IMPACT OF CONIFER AFFORESTATION ON WATER QUALITY IN AN UPLAND CATCHMENT IN SOUTHWEST ENGLAND.
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
A. G. Williams, J. L. Ternan, and M. Kent.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 451-461, 3 fig, 1 tab, 20 ref.

Descriptors: *Acid rain, *Acid streams, *Conifers, *England, *Forest hydrology, *Forest watersheds, *Reforestation, *Watershed management, Acidification, Flow pattern, Forest soils, Groundwater movement, Litter, Nutrients, Organic acids, Soil water, Soil-water-plant relationships, Solute transport, Spruce trees, Stemflow, Throughfall, Water quality.

Several studies in the past have noted an increase in the acidity of streams draining forested areas compared with adjacent non-forest vegetation types, attributed to the effects of acid deposition enhanced by the presence of trees or soil acidification resulting from the coniferous forest cover. An understanding of flow paths is crucial to an investigation of the effects of conifer trees on stream-water quality. Solute concentrations in throughfall, stemflow, litterflow, soil water, and springs were monitored in a sitka spruce (Picea sitchensis) forest and in a nonforested area in southwest England. Analyses of stream water upstream and downstream of the afforested area revealed increased solute concentrations resulting from enhanced entrapment of atmospheric salts by the trees and increased weathering arising from the production of organic acids and chelates from decaying spruce needles. No significant difference in acidification upstream and downstream of the forest was observed. It was concluded that release of nutrients from litter decomposition balances nutrient uptake and the release of base cations by weathering buffers the system. (See also W91-06510) (Author's abstract)
W91-06552

AQUATIC TOXICOLOGY AND RISK ASSESSMENT.
Thirteenth Volume. STP 1096. ASTM, Philadelphia, PA. 1990. 378p. Edited by W. G. Landis and W. H. van der Schalie.

Descriptors: *Aquatic environment, *Ecotoxicology, *Monitoring, *Risk assessment, *Toxicity, *Toxicology, *Water pollution effects, Biodegradation, Fate of pollutants, Lethal limit, Path of pollutants, Sediments, Sublethal effects.

Aquatic toxicology is very much an applied science, its driving force being toxicity testing for compliance with the Federal Clean Water Act; the Federal Insecticide, Fungicide, and Rodenticide Act; the Toxic Substances Control Act; and the Comprehensive Environmental Response Compensation and Liability Act. The conduct of basic research in order to understand underlying mechanisms and to improve the ability to perform risk assessments is still, judged by total economic outlay, a relatively small effort. The tenth volume contained a multi-author paper reviewing the first ten years of symposia and predicting the future. One of the most interesting trends was the decline in methods papers and the increase in interpretive, perspective, and laboratory-to-field papers. This trend may have been due to the optimization of the first round of toxicity testing techniques and to trying to understand the implications of data generated by these tests. One of the more disturbing trends noted was the lack of integrative papers in the first ten symposia. Comparing the contents of the papers in this volume with the trends observed three years ago may be useful. This volume reflects the increasing emphasis on the development of new techniques to examine the molecular and cellular effects of toxicants. These new techniques evaluate organism response to toxic exposures in ways that traditional acute and chronic assays cannot. As the more traditional techniques, these methods must be integrated into a hazard and risk assessment framework. As in previous volumes, this volume contains papers that report toxicities of a variety of materials. The papers are divided in the following headings: risk assessment and aquatic toxicology; biodegradation and environmental fate of xenobiotics; sediment toxicity and bioavailability; aquatic toxicology; comparative aquatic toxicity and mechanisms; and sublethal indicators of toxic stress. (See W91-06692 thru W91-06716) (Lantz-PTT)
W91-06691

ENVIRONMENTAL RISK ASSESSMENT/ENVIRONMENTAL HAZARD ASSESSMENT: SIMILARITIES AND DIFFERENCES.
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. W. Suter.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 5-15, 3 fig, 1 tab, 24 ref.

Descriptors: *Hazards, *Risk assessment, *Toxicology, *Water pollution effects, Data interpretation, Ecotoxicology, Environmental effects, Model studies, Regulations, Safety, Toxicity.

Risk and hazard assessment are alternate paradigms for assessing the effects of chemicals and other hazards of the environment. Risk assessment is an old assessment tradition that grew out of actuarial statistics and is concerned with estimating the probability of undesired events. Hazard assessment was developed in the late 1970s as a means of performing assessments by iteratively: (1) testing and measuring the properties of chemicals, (2) comparing toxicity test end points to estimated environmental concentrations, and then deciding whether the chemical is clearly safe, clearly hazardous or requires more testing. These two paradigms have much in common in that they attempt to imply environmental toxicology, environmental chemistry, and scientifically based logic to the regulation of chemicals. However, they differ in the following ways: (1) risk assessment is explicitly probabilistic, (2) hazard assessment assumes that clear distinctions can be made between safe and unsafe, but risk assessments determine degrees of safety, (3) risk assessment allows for value judgements and hazard assessment implies that decisions about acceptability are scientific, (4) risks, unlike hazards, are balanced against costs and benefits, (5) risk assessments have explicit endpoints, (6) hazard assessments monitor environmental concentrations, but risk assessments model exposure, (7) hazard assessment requires tiered testing, but risk assessments can be performed with available data, (8) procedural decisions in hazard assessments are based on the assessor's judgement, but risk assessments use formal decision criteria, and (9) risk assessment makes greater use of mathematical and statistical models. (See also W91-06691) (Author's abstract)
W91-06692

AQUATIC COMMUNITY RESPONSE TO STRESS: PREDICTION AND DETECTION OF ADVERSE EFFECTS.
Pennsylvania State Univ., University Park. School of Forest Resources.
J. R. Pratt.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 16-26, 4 fig, 5 tab, 40 ref. US Army Medical Research and Development Command Contract DAMD17-88-C-8068.

Descriptors: *Aquatic environment, *Ecotoxicology, *Stress, *Toxicity, *Toxicology, *Water pollution effects, Ecological effects, Ecosystems.

General ecological principles have been used to hypothesize community stress responses. A review of responses of microcosms, mesocosms, and ecosystems to chemical stressors indicated that changes in taxonomic and standing crop measures of community structure were usually reliable and sensitive indicators of stress response. Changes in process rates showed less frequent response to chemical stressors. Ecosystem experiments have not demonstrated some predicted changes even at extreme levels of stress. Problems in demonstrating community and ecosystem responses may be a result of present methodologies, or may identify failures of ecologists to accurately predict stress effects. Many ecosystem processes are substrate limited and robust even under stress. Although additional information is needed on the natural variability of measures of both structure and process, stress measures based on the composition of biological communities seem to have the greatest promise for evaluating ecosystem conditions. (See also W91-06691) (Author's abstract)
W91-06693

AQUATIC TEST SYSTEMS FOR STUDYING THE FATE OF XENOBIOTIC COMPOUNDS.
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5B.
W91-06694

USE OF MICROCOSMS VERSUS CONVENTIONAL BIODEGRADATION TESTING FOR ESTIMATING CHEMICAL PERSISTENCE.
Monsanto Co., St. Louis, MO.
D. B. Carson, V. W. Saeger, and W. E. Gledhill.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 48-59, 5 fig, 1 tab, 36 ref.

Descriptors: *Biodegradation, *Fate of pollutants, *Microenvironment, *Path of pollutants, *Toxicology, *Water pollution effects, Bioassay, Biological studies, Biphenyls, Chemical analysis, Esters, Laboratory methods, Organic compounds, Phosphate esters, Phthalates, Sulfonates.

Extrapolation of laboratory biodegradation data to the field is critical in assessing the environmental fate of a chemical. Laboratory systems used to evaluate biodegradation may vary from simple river or lake die-away tests to complex microcosms. The relative merits of rate data derived from systems of widely varying complexity have long been a subject of discussion. Data obtained from studies utilizing simple screening tests and microcosms containing sediment and natural water are presented and compared. Among the chemicals tested are: biphenyl, linear alkylbenzene sulfonates, and phthalate and phosphate esters. Results suggest that pertinent biodegradation rate data can be obtained from relatively uncomplex test systems. Potential concerns about the environmental fate of test chemicals raised in simpler biodegradation tests could be addressed by specific environmental monitoring for existing chemicals rather than testing in more complex systems. Key parameters concerning a chemical's biodegradability can be established from relatively uncomplex studies in natural waters or water/sediment systems. The need or indeed the utility of expensive complex microcosms for establishing such data should be questioned. Microcosms are useful laboratory tools for deriving information on site-specific environmental processes. Microcosms cannot, however, encompass the myriad complexities that exist in nature. The effects of nutrient deficiencies, temperature fluctuations, trophic level interactions, biogeochemical cycling, and other environmental parameters on microbial degradation cannot be totally assessed in microcosm studies. Information required for the safety assessment of a chemical beyond that generated from simpler biodegradation test systems could be obtained from site-specific environmental monitoring, rather than from complex microcosms. (See also W91-06691) (Lantz-PTT)
W91-06695

TESTING SEDIMENT TOXICITY WITH HYALELLA AZTECA (AMPHIPODA) AND CHIRONOMUS RIPARIUS (DIPTERA).
National Fisheries Contaminant Research Center, Columbia, MO.
For primary bibliographic entry see Field 5A.
W91-06698

COMPARATIVE SENSITIVITY OF SEDIMENT TOXICITY BIOASSAYS AT THREE SUPERFUND SITES IN PUGET SOUND.
PTI Environmental Services, Bellevue, WA.
For primary bibliographic entry see Field 5A.
W91-06700

EFFECTS OF SEDIMENT AND THE ROUTE OF EXPOSURE ON THE TOXICITY AND ACCUMULATION OF NEUTRAL LIPOPHILIC AND MODERATELY WATER-SOLUBLE METABOLIZABLE COMPOUNDS IN THE MIDGE, CHIRONOMUS RIPARIUS.
Ohio State Univ., Columbus. Dept. of Zoology.
M. J. Lydy, K. A. Bruner, D. M. Fry, and S. W. Fisher.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 140-164, 5 fig, 3 tab, 45 ref.

Descriptors: *Bioaccumulation, *Biochemistry, *Path of pollutants, *Sediments, *Toxicity, *Toxicology, *Water pollution effects, Dissolved organic compounds, Lethal limit, Midges, Naphthol, Organic compounds.

The toxicity and accumulation of eleven moderately water soluble metabolizable (MSM) or neutral lipophilic (NL) compounds were examined in the midge Chironomus riparius in tests without sediment (water only), and in treatments with sediment to which the test chemical was added directly to the water (spiked water) or directly to the sediment (spiked sediment). In general, the toxicity of NL compounds was significantly reduced when sediment was present regardless of whether the compound was added to the water or the sediment. The observed reduction in toxicity when sediment was present was attributed to sorption of the chemical to sediment, dissolved organic carbon (DOC), and particulates, and was anticipated from the literature. The toxicity and accumulation of MSM compounds in sediment and nonsediment systems were much more variable than for the NL compounds. For 1-naphthol, no significant difference in the distribution of parent chemical was seen in the water or sediment when used, although the toxicity of 1-naphthol was lowest when the compound was added directly to water in the presence of sediment. For the remaining MSM compounds, toxicity was significantly reduced only when the chemical was added directly to the sediment. In

general, partition coefficients were less useful in predicting the environmental behavior of MSM compounds. The most notable effect of sediment upon the MSM group was that the persistence of the parent compound was greatly increased in the sediments when the chemical was added to the sediment. (See also W91-06691) (Author's abstract)
W91-06701

USE OF THE BLUE MUSSEL, MYTILUS EDULIS, IN WATER QUALITY TOXICITY TESTING AND IN SITU MARINE BIOLOGICAL MONITORING.
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W91-06702

AQUATIC TOXICITY OF THE SENSORY IRRITANT AND RIOT CONTROL AGENT DIBENZ-(B,F)-1,4-OXAZEPINE (CR).
Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD. Environmental Toxicology Branch.
D. W. Johnson, M. V. Haley, and W. G. Landis.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 176-188, 4 fig, 3 tab, 17 ref.

Descriptors: *Aquatic environment, *Bioassay, *Dibenzoxazepine, *Toxicity, *Toxicology, *Water pollution effects, Algae, Aromatic compounds, Daphnia, Lethal limit, Minnow, Sublethal effects.

The aquatic toxicity of dibenz(b,f)-1,4-oxazepine (CR) was examined using organisms from three trophic levels. The compound is a peripheral sensory irritant which produces an immediate irritation of the eyes, nose, mouth and skin, and respiratory tract in man. The compound is comprised of a double benzene ring with a shared oxygen molecule and a double-bonded carbon, nitrogen group. The intended use of the compound is for the control of civil disturbances. Acute bioassays were performed using Ankistrodesmus falcatus, Daphnia magna and Pimephales promelas. A 21 day static renewal test was performed using D. magna. At 24-h EC50 of 0.48 mg/L and 48-h EC50 of 0.94 mg/L were calculated for daphnids. Significant differences in reproductive output and body length were observed at 0.50 mg/L using ANOVA in the 21 day chronic assay with D. magna. The 96 hour algal growth inhibition test yielded an IC50 in the range of 1.95 to 3.55 mg/L. An LC50 of 2.6 to 2.8 mg/L was determined for the fish. An enhancement compared to controls in reproductive output was observed for both the algae and daphnia at low concentrations of CR. Dose response curves and comparisons of linear and exponential regressions are presented for several toxicity tests. (See also W91-06691) (Author's abstract)
W91-06703

SHORT-TERM AMPHIBIAN TOXICITY TESTS AND PARAQUAT TOXICITY ASSESSMENT.
NSI Technology Services Corp., Corvallis, OR.
G. Linder, J. Barbitta, and T. Kwaiser.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 189-198, 2 fig, 2 tab, 49 ref.

Descriptors: *Agricultural chemicals, *Amphibians, *Paraquat, *Pesticides, *Toxicity, *Toxicology, *Water pollution effects, Bioassay, Ecological effects, Frogs, Hazard assessment, Herbicides, Weed control.

Changes in agricultural practice may alter agrichemical effects on nontarget wildlife. Because of routine practice in various forms of conservation tillage, paraquat (1,1'-dimethyl-4,4'-bipyridinium dichloride) has been increasingly used for weed control in agricultural fields and in supporting management practices. Though highly adsorbed in soil and foliage, paraquat may gain increased notice as an agrichemical potentially impacting wetlands which surround much of the farmland across the country; consequently amphibian toxicity evaluations may be incorporated into wildlife hazard assessments conducted for chemicals finding increased use in conservation tillage. Using amphibians representative of two anuran families, early life stage toxicity tests (96-h modified FETAX) were performed. Acute and subacute exposures were completed, and toxicity endpoints (mortality and teratogenicity) were evaluated for exposures to technical grade and formulation grade paraquat. These preliminary toxicity assessments suggest that acute and subacute endpoints for each form of paraquat may be significantly different, since the commercial formulation was three times as acutely toxic as the technical-grade chemical. Furthermore, it appears that species and familial differences must be regarded with increased caution until a comparative toxicity database is developed for amphibians. (See also W91-06691) (Author's abstract)
W91-06704

TOXICITY OF NITROGEN-CONTAINING AROMATIC COMPOUNDS (NCACS): QUINOLINE AND 4-AZAFLUORENE BEHAVIOR IN AN ESCHERICHIA COLI TEST SYSTEM--EVIDENCE OF MEMBRANE EFFECTS.
Virginia Inst. of Marine Science, Gloucester Point. Div. of Chemistry and Toxicology.
W. J. Catallo, D. R. Cleland, and M. E. Bender.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 199-221, 11 fig, 1 tab, 50 ref.

Descriptors: *Aromatic compounds, *Escherichia coli, *Nitrogen compounds, *Quinoline, *Toxicity, *Toxicology, *Water pollution effects, Azafluorene, Bioassay, Biochemistry, Ecotoxicology, Electron transport, Iodonitrotetrazolium chloride, Laboratory methods, Microbiological studies.

Research was conducted which addressed the effects of two prominent nitrogen-containing aromatic compounds (NCACs), quinoline and 4-azaflourene, on respiratory electron transport (ET) in Escherichia coli. ET was estimated spectrophotometrically using reduction rates of iodonitrotetrazolium chloride (INT), which is reduced in vivo to a red colored formazan (INTF). It was noted that both NCACs gave anomalous dose-response behavior in INT assays: in a defined 'threshold' dose range, INT reduction rates near or above the controls were observed. Compared with controls and low doses, the threshold doses for the NCACs showed different INT reduction kinetics, decreased cellular oxygen consumption, and decreased viable cell densities. These observations and experiments with E. coli spheroplast preparations, gram positive cells, and deep rough mutants supported the hypothesis that the NCACs caused removal of outer membrane constituents and probably interference with cell membrane function. Data from INT bioassays, comparative oxygen demand studies, assays of INT response in bacteria with different outer membrane characteristics, and transmission electron microscopy support the hypothesis. (See also W91-06691) (Author's abstract)
W91-06705

REDUCIBLE DYE 2-(P-IODOPHENYL)-3-(P-NITROPHENYL)-5-(PHENYL)-2H-TETRAZOLIUM CHLORIDE (INT) FOR USE IN AQUATIC TOXICOLOGY: NOTES ON CHEMICAL STRUCTURE, ELECTROCHEMISTRY, AND TOXICITY.
Virginia Inst. of Marine Science, Gloucester Point. Div. of Chemistry and Toxicology.
W. J. Catallo, R. J. Gale, R. L. Wong, and M. E. Bender.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 222-236, 9 fig, 1 tab, 48 ref.

Descriptors: *Aquatic environment, *Bioindicators, *Chemical analysis, *Ecotoxicology, *Toxicity, *Toxicology, *Water pollution effects, Biochemistry, Electron transport, Iodonitrotetrazolium chloride, Laboratory methods, Triphenyltetrazolium chloride.

Studies of 2-(p-iodophenyl)-3-(p-nitrophenyl)-2H-tetrazolium chloride (INT) chemical structure and aqueous electrochemistry at Hg, C, and Pt electrodes were conducted to address conceptual difficulties in the published literature, and questions arising from INT behavior in current bioassay systems. There has been both inaccuracy and inconsistency in the presentation of structural, electrochemical, and mechanistic data on tetraphenyltetrazolium chloride (TPT), INT and their formazons in published literature. This is due to the difficulties of working with these materials in complex environments such as electroanalytical and biological systems. As a result of the heterogeneity and physiochemical disparity between these systems, sites of biological reduction of TPT, INT, and related compounds cannot be directly inferred from data generated at electrodes. Typically, the half wave reduction potential values for biological electron transport chains (e.g., NADH to CoQ to cytochromes to oxygen) are derived from experiments in model systems and from theoretical relationships between reactant-product free energy changes and the half wave reduction potential. These estimates do not account for reactivity effects arising from microenvironments, catalysis, and quantum mechanical tunneling of electrons and protons in living systems. Electrochemical data show: (1) normal pulse polarography (NPP) and differential pulse polarography (DPP) of INT gave half wave reduction potential of the first wave between +0.126 and +0.073 V vs. standard hydrogen electrode (SHE); (2) the maximum reduction potential for formation of INTF on Pt was between +0.116 and +0.125 V vs. SHE and the values on C electrodes were comparable; (3) INT to INTF reductions at Pt and C electrodes appear to be mediated by two direct one electron reductions and disproportionation by one proton; and (4) the presence of interfering reactions involving adsorbed H species or radicals were possible on Pt and C. (See also W91-06691) (Lantz-PTT)
W91-06706

FLOW CYTOMETRIC TECHNIQUES TO ASSESS TOXICITY TO ALGAE.
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
W. R. Gala, and J. P. Giesy.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 237-246, 3 fig, 2 tab, 29 ref.

Descriptors: *Algae, *Flow cytometry, *Laboratory methods, *Toxicity, *Toxicology, *Water pollution effects, Atrazine, Bioassay, Detergents, Fluorescence, Herbicides, Lethal limit, Organic compounds, Sodium dodecyl sulfate.

Flow cytometry provides a fast and quantitative method to determine the effects of a toxicant on individual algal cells. The effects of the surfactant, sodium dodecyl sulfate (SDS), and the herbicide, atrazine, on the viability of Selenastrum capricornutum cells as measured by monitoring green fluorescence of algal cells stained with fluorescein diacetate (FDA) by flow cytometric techniques, were compared to the results of standard 96-h algal toxicity tests. Cell viability (green fluorescence) was a sensitive measure of the effects of SDS on S. capricornutum. The EC50 values for the reduction of the viability of cells after 48-h of exposure was 104.8 mg/L SDS (95% C.I., 63.7 to 172.3 mg/L), which was similar to the 96-h EC50 for specific growth rate (81.4 mg/L SDS; 95% C.I., 62.0 to 106.8 mg/L). Cell viability was not as sensitive to the effects of atrazine as was growth rate because of the algistatic properties of this herbicide. The 96-h EC50 of atrazine for algal growth rate was 128.2 microgm/L (95% C.I., 118.9 to 132.2 micro g/L, relative to the 48-h EC50 of 1500 micro g/L atrazine for cell viability was able to distinguish between algicidal and algistatic toxicants. (See also W91-06691) (Author's abstract)
W91-06707

USE OF HAZARD MODELS IN EVALUATING THE EFFECT OF EXPOSURE DURATION ON THE ACUTE TOXICITY OF THREE PESTICIDES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. W. Moore, M. D. Schluchter, and G. I. Scott.
IN: Aquatic Toxicology and Risk Assessment.

STP 1096. ASTM, Philadelphia, PA. 1990. p 247-263, 3 fig, 4 tab, 13 ref. EPA Grant No. CR-813138-02-0 and South Carolina Sea Grant Consortium Grant No. SD85-10.

Descriptors: *Data interpretation, *Hazard assessment, *Model studies, *Pesticides, *Toxicity, *Toxicology, *Water pollution effects, Azinphosmethyl, Ecotoxicology, Endosulfan, Fenvalerate.

Renewal toxicity tests (96-h) were conducted with the emulsifiable concentrates of three pesticides: azinphosmethyl, endosulfan, and fenvalerate. A second test design which incorporated a 6-h period of exposure followed by 90-h of observation, was also conducted on these three pesticides. Toxicity results from the two test types were then compared using different hazard models to test a series of null hypotheses. These comparisons indicated: (1) while the effect of concentration was contrasted across time, hazard changed for each of the test types; and (2) when the effect of concentration was the same for the initial periods of exposure (6 and 24-h) in the two test designs, the average hazard was significantly lower for the 6 h exposure than for 24 h. This study may have significant implications for relating results from laboratory toxicity tests to mortality among organisms exposed in situ. The 6-h exposure test design provides information on delayed effects due to short-term exposures, while hazard analysis can be used to estimate the underlying time/concentration relationship from standard laboratory toxicity test data. (See also W91-06691) (Author's abstract)
W91-06708

COMPARATIVE DEVELOPMENTAL TOXICITY OF ACETYLENIC ALCOHOLS ON EMBRYOS AND LARVAE OF XENOPUS LAEVIS.
Tennessee Univ., Knoxville. Coll. of Veterinary Medicine.
D. A. Dawson, T. W. Schultz, L. L. Baker, and T. S. Wilke.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 267-277, 4 tab, 16 ref. EPA Cooperative Agreement CR-813158-02-0.

Descriptors: *Acetylenic alcohols, *Embryonic growth stage, *Frogs, *Larvae, *Toxicity, *Toxicology, *Water pollution effects, Amphibians, Biochemistry, Ecotoxicology, Lethal limit, Organic compounds, Physiological ecology.

Xenopus laevis embryos and larvae were tested to assess the relative toxicity and teratogenicity of a series of 14 acetylene alcohols. Tertiary propargylic alcohols and alkene-ols were expected to act as simple narcotics and not be teratogenic. However, primary and secondary propargylic and homopropargylic alcohols might be metabolically activated by alcohol dehydrogenase, to become teratogenic. Mid-blastula to late-blastula stage embryos were exposed to graded concentrations of each alcohol for 96-h. Embryo malformation (EmEC50) and lethality (EmLC50) endpoints were determined for each alcohol, and the Mortality/Malformation Index (MMI) was calculated as a measure of relative teratogenic potential. Additionally, untreated, healthy-appearing, 5 d old tadpoles were exposed to each alcohol for 96-h, and the tadpole lethality endpoint (Td5LC50) was determined. The ratio of the embryo LC50 to tadpole LC50(E/T) was calculated as a measure of alcohol reactivity. The primary propargylic alcohols had teratogenic potential, producing head, eye, gut, and skeletal malformations and MMI values >3.0. All other alcohols caused only edema and improper gut coiling. The E/T ratios indicated that primary and secondary propargylic and homopropargylic alcohols were reactive, whereas tertiary propargylic alcohols and alkene-ols were not. In addition, quantitative structure-activity relationships (QSARs) were explored, and a comparison of the tadpole and flathead minnow lethality data indicated that toxicity in one system can be used to predict toxicity in another. (See also W91-06691) (Author's abstract)
W91-06709

TOXICITY AND TOXICOKINETICS OF PENTACHLOROPHENOL AND CARBARYL TO PONTOPOREIA HOYI AND MYSIS RELICTA.
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
P. F. Landrum, and W. S. Dupuis.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 278-289, 1 fig, 3 tab, 27 ref.

Descriptors: *Amphipods, *Carbaryl, *Ecotoxicology, *Pentachlorophenol, *Shrimp, *Toxicity, *Toxicology, *Water pollution effects, Bioassay, Biological studies, Lethal limit, Model studies, Organic compounds.

Two Great Lakes invertebrates, the amphipod Pontoporeia hoyi and the mysid shrimp Mysis relicta, were exposed to pentachlorophenol (PCP) and carbaryl to determine acute mortality. At pH 8, the LC50 for P. hoyi after 96-h was 0.6 +/-0.3 micro g/mL for PCP, while that for carbaryl was 0.23 +/-0.04 micro g/mL. The LC50 for M. relicta at pH 8 and 96 was 54.1 +/-10.3 micro g/mL for PCP and for carbaryl 0.23 microgm/mL (0).103-0.356, n=2). The differences between the LC50 values between P. hoyi and M. relicta for PCP result in part from differences in the uptake clearances of the two animals, 3.1 +/-0.9 mL/g/h for P. hoyi compared to 0.4 +/-0.1 mL/g/h for M. relicta. A similar difference occurred in the respective carbaryl uptake clearances for the two organisms, 3.74 +/-0.63 mL/g/h for P. hoyi and 0.134 mL/g/h (0.135 to 0.133, n=2) for M. relicta. The cumulative toxicant concentrations in the organisms that result in 50% mortality, LD50, were estimated from a toxicokinetics model that was parameterized with the measured uptake and elimination constants and the LC50 values. The M. relicta LD50 for PCP was approximately ten times larger than that for P. hoyi and confirmed the relative sensitivities of the organisms as described by their respective LC50 values. For carbaryl, the LD50 for P. hoyi was greater than that for M. relicta. Thus, M. relicta is apparently more sensitive to accumulated carbaryl than P. hoyi despite the similar LC50 values for the two organisms. (See also W91-06691) (Author's abstract)
W91-06710

RESPONSE OF DIPLOID AND POLYPLOID RAINBOW TROUT CELLS FOLLOWING EXPOSURE TO GENOTOXIC COMPOUNDS.
Rangen Aquaculture Research Center, Hagerman, ID.
D. B. Powell, and R. M. Kocan.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 290-308, 10 fig, 1 tab, 37 ref. National Institute of Environmental Health Sciences (2 T32 ESO7032).

Descriptors: *Fish physiology, *Genotoxicity, *Toxicity, *Toxicology, *Trout, *Water pollution effects, Benzopyrene, Bioassay, Biochemistry, Carcinogens, DNA, Methylnitronitrosoguanidine, Phosphorus radioisotopes.

Polyploid cells have been associated with malignant neoplasms in many animal species. Recent advances in genetic engineering of aquatic vertebrates have made it possible to produce healthy rainbow trout (Oncorhynchus mykiss, formerly Salmo gairdneri) that are completely triploid (3n) or tetraploid (4n). The objectives of this study were to compare the effects of direct and indirect acting carcinogens on DNA repair and measure the relative binding of benzol(a)pyrene (B(a)P) to DNA in diploid and polyploid cells. The level of DNA repair was measured in diploid and polyploid cells following an in vitro exposure to the direct acting carcinogen N-methyl-N'-nitro-N-nitrosoguanidine (MNNG) or the indirect acting carcinogen B(a)P. A DNA repair assay was used to compare the effects of MNNG and (B(A)P) on nucleated erythrocytes and hepatocytes. Diploid and polyploid hepatocytes responded more strongly to MNNG than to B(a)P. DNA repair activity per haploid genome in polyploid fish hepatocytes was found to be greater than in diploid hepatocytes. Tetraploid cells consistently exhibited slightly more than twice the unscheduled DNA synthesis of diploid cells. Rainbow trout erythrocytes were completely refractory to MNNG and B(A)P in the DNA repair assay. The P-postlabeling assay, which measures DNA bound compounds, indicated that at least 5 distinct DNA adducts are formed in rainbow trout liver cells following exposure to B(a)P. Diploid and tetraploid cells were found to contain significant differences in the relative number of specific adducts. No adducts were detected in the DMSO solvent controls. (See also W91-06691) (Author's abstract)
W91-06711

PEROXISOME PROLIFERATION AS AN EPIGENETIC MECHANISM OF CARCINOGENESIS: RELEVANCE TO AQUATIC TOXICOLOGY.
Massachusetts Univ., Amherst. School of Public Health.
J. H. Yang, P. T. Kostecki, and E. J. Calabrese.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 309-327, 1 fig, 3 tab, 99 ref. Army Medical Research and Development Command Contract DAMD17-88-C-8051.

Descriptors: *Aquatic environment, *Cancer, *Ecotoxicology, *Peroxisomes, *Toxicity, *Toxicology, *Water pollution effects, Biochemistry, Enzymes, Fish physiology, Trout.

Preliminary studies at the University of Massachusetts showed a significant induction of peroxisomal enzymes including acyl-CoA oxidase, catalase, and polypeptide PPA-80 in rainbow trout injected via I.P. with known rodent peroxisome proliferators (clofibrate, criprobrate, lacofen, and DEHP). The trout treated with 75 mg/kg of clofibrate for three weeks on alternating days showed a significant ($p = 0.01$) increase (34%) of peroxisomal oxidase activity with no increase in liver weight. The treatment of trout with ciprofibrate showed significant dose-related increases in peroxisomal acyl-CoA activity was highest (78%) at high dose (35 mg/kg). Polypeptide PPA-80 and catalase revealed 48% and 236% increases at the highest dose, respectively. Exposure of trout to lactofen for two weeks with daily injections resulted in a 20% increase in peroxisomal oxidase activity at low dose (50 mg/kg) and 22% increase in polypeptide PPA-80 at mid-dose (100 mg/kg), respectively. These results indicate that each agent displayed evidence of hepatic peroxisome proliferation in the rainbow trout as indicated by the increased acyl-CoA oxidase activities and/or increases in the amount of polypeptide PPA-80. The magnitude of increase in enzyme activities varied according to agent tested and dosage, as well as period of exposure. Although direct comparisons between the agents are difficult due to the differences in dosage and exposure period, the level of induction in peroxisomal acyl-CoA oxidase appears to be in the descending order of ciprofibrate > clofibrate > lactofen > DEHP. Such relative ranking of the capacity to induce this peroxisomal enzyme by the respective agent in rainbow trout is similar to that seen in rats. (See also W91-06691) (Lantz-PTT)
W91-06712

REDUCTION IN THE NUMBERS OF ANTIBODY-PRODUCING CELLS IN RAINBOW TROUT, ONCORHYNCHUS MYKISS, EXPOSED TO SUBLETHAL DOSES OF PHENOL BEFORE BATH IMMUNIZATION.
National Fish Health Research Lab., Kearneysville, WV.
D. P. Anderson, O. W. Dixon, and W. B. van Muiswinkel.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 332-337, 4 fig, 23 ref.

Descriptors: *Fish physiology, *Phenols, *Sublethal effects, *Toxicology, *Trout, *Water pollution effects, Biochemistry, Ecotoxicology, Lethal limit, Organic compounds, Toxicity.

The numbers of splenic antibody-producing cells were reduced in groups of fish given a 2, 5, or 30 min bath exposure to 10 ppm phenol before immunization by bath with the bacterin, Yersinia ruckeri O-antigen. The lethal time of 50% (LT50) for the 10 ppm phenol bath was 45 minutes. The passive

hemolytic plaque assay was used to monitor the numbers of antibody producing cells in the phenol-pretreated and sham-treated fish 14 or 21 days after contaminant exposure, and 5 minute bath immunizations at 10 or 100 micro g/mL. The results, documenting a suppression of the immune response to bath immunization following a brief exposure to a toxicant, may help to explain delayed mortalities where pollution is indicated. (See also W91-06691) (Author's abstract)
W91-06713

STRESS PROTEINS: THEIR DETECTION AND USES IN BIOMONITORING.
Maryland Univ. Baltimore County, Catonsville. Dept. of Biological Sciences.
B. P. Bradley.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 338-347, 4 fig, 19 ref.

Descriptors: *Bioassay, *Bioindicators, *Ecotoxicology, *Monitoring, *Proteins, *Stress, *Toxicology, *Water pollution effects, Autoradiography, Densitometry, Electrophoresis, Field tests, Immunoassay, Laboratory methods, Sublethal effects, Toxicity, Water quality.

Stress proteins can be detected quite easily autoradiographically or immunologically. A field immunoassay is feasible, allowing early warning of environmental problems as well as in situ monitoring. More sophisticated laboratory assays are also available, combining gel electrophoresis, autoradiography, immunoassays and densitometry to confirm the field assessment and perhaps to suggest the physical or chemical stressor or stressors causing the problem. The tests can be done on live, fresh, or preserved specimens. Assaying preserved specimens allows samples from different areas and times to be tested simultaneously. However, some questions need to be resolved before stress proteins are routinely used in biomonitoring--how persistent specific stress proteins are and what the thresholds are for different species; how to measure variation in levels of heat shock proteins under natural conditions, daily and seasonal cycles; and how to demonstrate a cause-effect relationship (not just a correlation) between stress protein levels and reproduction or survival so that the response can not only be a biomarker but a bona fida measure of the condition of the organism and therefore of its environment. (See also W91-06691) (Lantz-PTT)
W91-06714

DNA DAMAGE AS AN INDICATOR OF POLLUTANT-INDUCED GENOTOXICITY.
Oak Ridge National Lab., TN. Environmental Sciences Div.
L. R. Shugart.
IN: Aquatic Toxicology and Risk Assessment. STP 1096. ASTM, Philadelphia, PA. 1990. p 348-355, 1 fig, 4 tab, 16 ref. DOE Contract No. DE-AC05-840R21400.

Descriptors: *DNA, *Genotoxicity, *Poplar Creek, *Toxicity, *Toxicology, *Water pollution effects, Biochemistry, Biological studies, Ecotoxicology, Hinds Creek, Monitoring, Sublethal effects, Sunfish, Tennessee.

The incidence of DNA strand breakage was measured in sunfish at several East Fork Poplar Creek (EFPC) sampling stations. Hinds Creek was shown to be a more appropriate reference site than Brushy Fork for the comparison of data. An alkaline unwinding assay that detects excess strand breakage within the DNA polymer was applied to a sunfish in a local stream as a biological monitor for environmental genotoxicity due to industrial pollution. These analyses began in May of 1987 and included sampling through August 1988. Fish at all EFPC sampling stations initially showed levels of DNA strand breakage significantly higher than fish from the reference site. These levels are decreasing with time. The data suggests that at most sampling sites the fish in EFPC experienced a decrease in genotoxic stress over the time course of this investigation. Fish at all three of the EFPC stations show a steady decline in DNA strand breaks over the 14 month period. The biological ramifications of the level of strand breakage found in the DNA of fish in EFPC are currently unknown, but such data should be interpreted in context with data obtained from other indicators of stress and toxicity. (See also W91-06691) (Lantz-PTT)
W91-06715

COASTAL OIL DRILLING PRODUCED WATERS: CHEMICAL CHARACTERIZATION AND ASSESSMENT OF GENOTOXICITY USING CHROMOSOMAL ABERRATIONS IN CYPRINODON VARIEGATUS.
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
For primary bibliographic entry see Field 4C.
W91-06716

EFFECTS OF NATURALLY OCCURRING HIGH AND LOW MOLECULAR WEIGHT INORGANIC AND ORGANIC SPECIES ON THE YOLK-SACK LARVAE OF ATLANTIC SALMON (SALMO SALAR L.) EXPOSED TO ACIDIC ALUMINUM-RICH LAKE WATER.
Isotope Laboratory, As, Norway.
E. Lydersen, A. B. S. Poleo, I. P. Muniz, B. Salbu, and H. E. Bjornstad.
Aquatic Toxicology AQTODG, Vol. 18, No. 4, p 219-230, December 24, 1990. 1 fig, 2 tab, 26 ref.

Descriptors: *Acid lakes, *Acid rain effects, *Aluminum, *Fish, *Norway, *Salmon, *Toxicity, *Water pollution effects, Acute toxicity, Fish larvae, Lake Lomstjern, Lake Nepptjern, Organic carbon, Organic compounds.

Yolk-sac larvae of Atlantic Salmon (Salmo salar L.) were exposed to water from two acidic, aluminum-rich lakes, Nepptjern and Lomstjern. The average pH of the lakes during the experiments were 4.85 and 5.24. The concentrations of total monomeric aluminum were high in both lakes (640 and 451 microg/L), but the total amount of organic carbon (TOC) differed significantly (1.89 and 11.6 mg C/L). The larvae were also exposed to cation exchanged and hollow fiber ultrafiltered water from both lakes. Based on the hollow fiber ultrafiltration, the toxic aluminum species were present in the inorganic, low molecular weight fraction (mol. wt. <3000 DA). Within this fraction, the highest mortality rates (LT50 of 24.6 h) were observed in the lake water having the highest amounts of aluminum hydrolysis products. The aluminum fluorides were also found to be toxic (LT50 of 49.6 h), but less toxic than the aluminum hydrolysis products. Removal of high molecular weight species including organic and inorganic Al species did not affect the toxicity or the mortality rates. No acute toxicity was observed when larvae were exposed to the cation exchanged eluates. Thus, the organic aluminum complexes seemed to have no acute toxic effect, at the concentration levels tested. (Author's abstract)
W91-06749

INTERFERENCE OF POLYCHLORINATED BIPHENYLS (CLOPHEN A50) WITH GAMETOGENESIS IN THE SEA STAR, ASTERIAS RUBENS L.
Utrecht Rijksuniversiteit (Netherlands). Research Group for Aquatic Toxicology.
P. J. den Besten, H. J. Herwig, A. C. Smaal, D. I. Zandee, and P. A. Voogt.
Aquatic Toxicology AQTODG, Vol. 18, No. 4, p 231-246, December 24, 1990. 3 fig, 4 tab, 26 ref.

Descriptors: *Bioaccumulation, *Echinoderms, *Path of pollutants, *Polychlorinated biphenyls, *Water pollution effects, Food chains, Marine animals, Reproduction.

The accumulation, distribution, and effects of polychlorinated biphenyls (PCBs) were studied in the sea star, Asterias rubens. Sea stars were exposed for 5 or 7 months to PCBs by a diet of muscles which had been fed with Clophen A50-contaminated algae. Seasonal changes of the PCB concentrations in pyloric caeca from unexposed sea stars and differences between the PCB contents of different organs were found to be related mainly to differences in the lipid contents. During PCB exposure via the food chain, an almost linear increase of PCB concentration in pyloric caeca and gonad was observed. After 7 months of exposure, the gonads of male and female sea stars contained 26 and 43%, respectively, of the total amount of accumulated PCBs. The PCBs were present in the oocytes and spermatozoa from exposed animals at levels comparable to those found for whole gonads. The PCB levels in experimentally exposed sea stars were found to be similar to those in animals collected directly from the polluted Dutch Western Scheldt. In PCB-exposed female sea stars, the gonad indices at the end of the reproductive cycle were significantly lower than in unexposed animals. No effects were found on the size of the oocytes or on the biochemical composition with respect to the overall glycogen, lipid, or protein levels and electrophoretic protein patterns. The gonad indices of PCB-exposed male sea stars were not different from those of unexposed animals. It is concluded that PCB exposure may have a negative effect on gonadal growth in female sea stars. (Author's abstract)
W91-06750

PRODUCTION AND POPULATION DYNAMICS OF PACHYMELANIA AURITA MULLER.
Ibadan Univ. (Nigeria). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W91-06757

SENSITIVITY OF TWO CLADOCERANS TO WATER QUALITY VARIABLES: SALINITY AND HARDNESS.
Dow Chemical Co., Midland, MI. Environmental Toxicology and Chemistry Research Lab.
U. M. Cowgill, and D. P. Milazzo.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 2, p 185-196, December 1990. 2 fig, 7 tab, 22 ref.

Descriptors: *Bioassay, *Bioindicators, *Hardness, *Salinity, *Toxicity, *Water pollution effects, *Water quality, *Water quality monitoring, *Waterfleas, Calcium carbonate, Daphnia, Effluent limitations, Lethal limit, Reproduction, Sodium chloride.

The sensitivity of two cladocerans, Daphnia magna and Ceriodaphnia dubia, to variations in salinity and hardness was studied using the three-brood test. The time it took the control animals to produce three broods generated the length of the three-brood test (7-9 days for C. dubia and 10 days for D. magna). Both organisms responded to sodium chloride within 2 to 4 days of exposure. D. magna was more tolerant than C. dubia (LC50 of 6034 and 2019 mg/L, respectively). The response to hardness was gradual, indicating a chronic effect. D. magna was less sensitive to hardness than C. dubia (LC50 of 1516 and 1031 mg calcium carbonate/L, respectively). Total progeny was a more sensitive endpoint than survival for both caldocerans exposed to sodium chloride and for C. dubia exposed to hardness. In the case of D. magna, the survival and total progeny endpoints were equally sensitive when variations in hardness were tested. To avoid stressing organisms needlessly in effluent testing, adherence to 'no observable effect' levels for sodium chloride (about 1200 mg/L) and hardness (approximately 650 mg calcium carbonate/L) should be observed. (Author's abstract)
W91-06762

PRENATAL EXPOSURE TO METHYL MERCURY AMONG GREENLANDIC POLAR INUITS.
Aarhus Univ. (Denmark). Dept. of Toxicology.
For primary bibliographic entry see Field 5B.
W91-06764

EFFECTS OF MERCURY, SELENIUM, AND ORGANOCHLORINE CONTAMINANTS ON REPRODUCTION OF FORSTER'S TERNS AND BLACK SKIMMERS NESTING IN A CONTAMINATED TEXAS BAY.

Patuxent Wildlife Research Center, Laurel, MD.
K. A. King, T. W. Custer, and J. S. Quinn.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 32-40, 1991. 2 fig, 5 tab, 48 ref.

Descriptors: *DDE, *Mercury, *Organochlorine pesticides, *Pesticide toxicity, *Polychlorinated biphenyls, *Selenium, *Water birds, *Water pollution effects, Bioassay, Chlorinated hydrocarbon insecticides, Eggs, Estuarine environment, Fertility, Heavy metals, Path of pollutants, Pesticide residues, Sublethal effects, Texas.

The objectives of this study were to determine the effects of mercury and other contaminants on reproduction of terns and black skimmers nesting on islands on Lavaca Bay, Texas and to measure concentrations of contaminants in eggs of terns nesting there. Mean mercury (Hg) (0.40 micrograms/g), and geometric mean DDE (1.6 micrograms/g) and polychlorinated biphenyl (PCB) (2.3 micrograms/g) concentrations in Forster's tern (Sterna forsteri) eggs from Lavaca Bay, Texas were higher than those in tern eggs from a reference area in San Antonio Bay, but residues were not correlated with hatching success. Nest success was similar between bays. Selenium (Se) levels in Lavaca Bay tern eggs (0.71 micrograms/g) were also comparable to those in eggs from the reference area (0.68 micrograms/g). Clutch size (3.1 to 3.4) of Lavaca Bay Black skimmers (Rynchops niger) was no different than that (3.4) as a reference colony near Laguna Vista. Nest success was lower at one Lavaca Bay colony (40%) than at Laguna Vista (65%). Mean mercury (Hg) (0.46 micrograms/g) and Se (0.75 micrograms/g) concentrations in skimmer eggs from Lavaca Bay were higher than those (0.19, 0.33 micrograms/g) from Laguna Vista; however, concentrations of neither contaminant were related to hatching success. DDE concentrations in Lavaca Bay skimmer eggs (3.4 micrograms/g) were similar to those from Laguna Vista (3.2 micrograms/g) and DDE was negatively correlated with hatching success. PCBs were higher in eggs from Lavaca Bay (1.3 micrograms/g) than Laguna Vista (0.8 micrograms/g). Organochlorine and metal contaminants in most eggs were below embryotoxic levels. Eggshell thinning in Forster's terns (7%) and black skimmers (5%) was below that associated with lowered reproduction. DDE and PCBs were detected in 9 Caspian tern (S. caspia) eggs; maximum concentrations were 4.7 and 5.4 micrograms/g. Caspian tern and least tern (S. albifrons) eggs contained low (< or = 0.9 micrograms/g) concentrations of mercury and selenium. (Author's abstract)
W91-06773

PRODUCTIVITY, DIET, AND ENVIRONMENTAL CONTAMINANTS IN BALD EAGLES NESTING NEAR THE WISCONSIN SHORELINE OF LAKE SUPERIOR.
Wisconsin Univ.-Stevens Point. Coll. of Natural Resources.
K. D. Kozie, and R. K. Anderson.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 41-48, 1991. 6 tab, 46 ref.

Descriptors: *Bald eagles, *Bioaccumulation, *Birds, *Chlorinated hydrocarbon insecticides, *DDE, *Lake Superior, *Path of pollutants, *Pesticide toxicity, *Polychlorinated biphenyls, *Water pollution effects, *Wisconsin, Animal tissues, Diets, Fertility, Gulls, Nesting, Organochlorine pesticides, Sublethal effects, Tissue analysis.

Bald eagles (Haliaeetus leucocephalus) nesting in the Apostle Islands National Lakeshore and along the Wisconsin shoreline of Lake Superior produced an average of 0.8 young/occupied nest and had an average nest success of 57% during 1983 to 1988, compared to 1.3 young/occupied nest and 77% nest success in inland Wisconsin. Organochlorine contaminant levels in nestling bald eagle carcasses collected from nests near Lake Superior were higher than those collected inland suggesting local contamination. Prey remains collected at nests consisted of fish (50%); birds, primarily herring gulls (Larus agentatus) (48.4%); and mammals (1.2%). Organochlorine and polychlorinated biphenyl (PCB) residues were present at low levels (DDE: average = 0.07 micrograms/g wet weight, PCB: average = 0.21 micrograms/g wet weight) in fish. Herring gulls contained higher concentrations (DDE: average = 5.5 micrograms / wet weight, PCB: average = 16.95 micrograms/g wet weight) and appear to be the major source of elevated contaminant levels in bald eagles nesting near Lake Superior. (Author's abstract)
W91-06774

POLYCHLORINATED BIPHENYL CONGENERS IN BLOOD OF WISCONSIN SPORT FISH CONSUMERS.
Wisconsin Univ.-Madison. Lab. of Hygiene.
For primary bibliographic entry see Field 5B.
W91-06775

ACUTE TOXICITY OF PURE PENTACHLOROPHENOL AND A TECHNICAL FORMULATION TO THREE SPECIES OF DAPHNIA.
Guelph Univ. (Ontario). Dept. of Environmental Biology.
G. L. Stephenson, N. K. Kaushik, and K. R. Solomon.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 73-80, 1991. 3 fig, 3 tab, 49 ref.

Descriptors: *Bioassay, *Daphnia, *Pentachlorophenol, *Pesticide toxicity, *Phenolic pesticides, *Toxicity, *Toxicology, *Water pollution effects, Chlorinated aromatic compounds, Dose-response relationships, Growth stages, Halogenated pesticides, Median tolerance limit, Mortality.

The acute toxicity of a technical formulation of pentachlorophenol (PCP) and pure pentachlorophenol to three age classes of Daphnia magna, and adult D. pulex and D. galeata mendotae was determined by static toxicity tests. The influence of a number of factors on toxicity of PCP was also examined. The 48 hour LC50 estimated from adult daphnids of the three species exposed to pure PCP were 1.78, 4.59 and 0.51 mg/L, respectively, while those for the technical formulation were 2.57, 3.66, and 0.33 mg/L, respectively. There was little difference in toxicity between the technical and pure PCP; however, toxicity of both forms of PCP was influenced by duration of exposure, age (and/or size) and species of test organism, and pH of the test solution. Pentachlorophenol caused a toxic response over a very narrow range of concentrations, with the greatest response occurring immediately between 0 and 24 hours. Pure PCP was equally toxic to all age classes of D. magna but susceptibility to technical PCP decreased with maturation. D. g. mendotae was ten times more sensitive than D. pulex to PCP. Pure PCP was significantly more toxic to D. magna at pH 5.5 than 7.0 with mean 48 hour LC50 values of 0.082 and 1.78 mg PCP/L, respectively. At 12 C, the toxicity of both forms of PCP to D. g. mendotae and D. pulex did not differ significantly from that at 20 C; however, technical PCP was significantly more toxic to D. magna at 12 C for an exposure duration of 48 hours. There was no effect of test container size (100, 250, 600 and 1,000 mL) on the toxicity of PCP to D. magna at 20 C with the lower pH of 5.5; suggesting that adsorption to glassware was not a factor in availability of PCP to test organisms. Beaker size had no effect on the toxicity of PCP to D. pulex at 20 C with test solutions having a pH of 7.0 to 8.0. (Author's abstract)
W91-06776

EFFECT OF HERBICIDE RESIDUES ON MICROBIAL PROCESSES IN POND SEDIMENT.
Clemson Univ., SC. Dept. of Microbiology.
A. Isolda, and S. S. Hayasaka.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 81-86, 1991. 3 tab, 20 ref.

Descriptors: *Bioassay, *Copper sulfate, *Herbicides, *Microbiological studies, *Microorganisms, *Pesticide toxicity, *Ponds, *Sediment contamination, *Simazine, *Water pollution effects, Mineralization, Path of pollutants, Sublethal effects, Toxicity, Triazine herbicides.

Herbicides contaminate aquatic environments through agricultural runoff, direct applications, and leaching into groundwater. Eventually, aquatic sediments become a sink for herbicides associated with organic and inorganic particulates. An assay system is described for examination of potential effects of herbicides in non-target sediment microorganisms. A key feature was to standardize a procedure for collecting and incubating intact miniature soil samples for assaying a variety of microbial activities. Potted pond sediment compared to undisturbed sediment cores showed no difference in initial carbon mineralization, acetylene reduction, phosphatase, and dehydrogenase activities, but did show a significant difference in methanogenesis. Copper sulfate (CuSO4), after one week in pond sediment, inhibited phosphatase activity (1,000 ppm CuSO4) and methanogenesis (20 to 1000 ppm CuSO4); no effect was noted for acetylene reduction, dehydrogenase activity and glucose mineralization. Simazine stimulated pond sediment acetylene reduction (1000 ppm simazine); inhibited phosphatase activity (1000 ppm simazine) and methanogenesis (50 to 1000 ppm simazine); and had no effect on dehydrogenase activity and glucose mineralization. Chronic effects and effects at lower concentrations by these herbicides were less apparent. The results support the concept that a battery of tests are required to profile and evaluate the effects of herbicides on sediment microbial communities. (Author's abstract)
W91-06777

ACUTE AND CHRONIC TOXICITY OF TEN CHLORINATED ORGANIC COMPOUNDS TO THE AMERICAN FLAGFISH (JORDANELLA FLORIDAE).
Lakehead Univ., Thunder Bay (Ontario). Aquatic Toxicity Research Group.
A. D. Smith, A. Bharath, C. Mallard, D. Orr, and K. Smith.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 94-102, 1991. 9 tab, 39 ref.

Descriptors: *Bioassay, *Chlorinated aromatic compounds, *Chlorinated hydrocarbons, *Pesticide toxicity, *Toxicity, *Toxicology, *Water pollution effects, Chronic effects, Embryonic growth stage, Fish, Growth rates, Halogenated pesticides, Lethal limit, Median tolerance limit, Mortality, Pentachlorophenol, Phenolic pesticides, Survival, Trichloroethylene.

The acute toxicity (96 hour median lethal concentrations (LC50s) of ten chlorinated isomers of benzene, phenol, ethane, and ethylene to the American flagfish (Jordanella floridae) were determined in both static and flow through systems. The 10 compounds and their 96 hour static LC50s (in micrograms/L) were: 1,2,4,5-tetrachlorobenzene (TTCB) (2080); 1,2,4-trichlorobenzene (TCB) (4000); 1,4-dichlorobenzene (DCB) (4480); pentachlorophenol (PCP) (186); 2,3,5,6-tetrachlorophenol (TTCP) (420 and 546); 2,4,6-trichlorophenol (TCP) (2260); 1,1,2,2-tetrachloroethane (TTCA) (26,800); 1,1,2-trichloroethane (TCA) (89,100); tetrachloroethylene (PCE) (4000); and trichloroethylene (TCE) (3100). Chronic toxicity to embryo-larval fish was also estimated from hatching success and post-hatch survival as well as fry growth rates and survival. Maximum acceptable toxicant concentrations (MATC) were estimated where possible. In general, for both acute and chronic toxicity tests, the order of increasing relative toxicity based on the water-borne exposure concentrations was: chloroethanes, chloroethylenes, chlorobenzenes, and chlorophenols. Within groups, more highly chlorinated isomers were usually more toxic. The presence of suspended or colloidal 1,2,4,5-tetrachlorobenzene was observed in acute toxicity testing and affected toxicity estimates. (Author's abstract)
W91-06779

MULTISPECIES TOXICITY TESTS USING INDIGENOUS ORGANISMS: PREDICTING THE EFFECTS OF COMPLEX EFFLUENTS IN STREAMS.
Virginia Polytechnic Inst. and State Univ., Blacks-

burg. Center for Environmental and Hazardous Material Studies.
K. W. Pontasch, and J. Cairns.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 103-112, 1991. 5 fig, 3 tab, 20 ref.

Descriptors: *Aquatic insects, *Dose-response relationships, *Macroinvertebrates, *Mayflies, *Stream pollution, *Toxicity, *Toxicology, *Water pollution effects, Bioassay, Effluents, Laboratory methods, Lethal limit, Microcosms, Midges, Mortality, Population density, Testing procedures.

A study was conducted to determine if contaminant-induced changes in macroinvertebrate communities in laboratory stream microcosms could be used to predict responses of these organisms in a natural stream receiving the same contaminant. Test organisms were transferred to the artificial streams in rock-filled containers previously colonized for 30 days upstream of the effluent outfall. The microcosms were exposed for 20 days to concentrations of the effluent that reflected those at field sites where macroinvertebrates were collected. The stream microcosms maintained most taxa at or above initial densities. However, adult insect emergence from the microcosms must be monitored during such studies. The relative sensitivity of species and the effluent concentrations causing changes in insect density were similar in the microcosms and the field. Mayflies were the most sensitive group, and densities in the microcosm were significantly ($P < or = 0.05$) reduced at 1.0% or 10.0% effluent concentration depending on species. Conversely, chironomid densities were increased by exposure to the effluent. The mayflies responded at lower concentrations than acute tests with Daphnia magna would have predicted. (Author's abstract)
W91-06780

IN VITRO RESPONSE OF THE BROWN BULLHEAD CATFISH CELL LINE, BB, TO AQUATIC POLLUTANTS.
Rockefeller Univ., New York. Lab. Animal Research Center.
N. Martin-Alguacil, H. Babich, D. W. Rosenberg, and E. Borenfreund.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 113-117, 1991. 3 fig, 1 tab, 35 ref. EPA Grant 813760.

Descriptors: *Bioassay, *Bioindicators, *Catfish, *Chlorinated hydrocarbon insecticides, *Fish physiology, *Pesticide toxicity, *Polycyclic aromatic hydrocarbons, *Toxicity, *Toxicology, *Trout, *Water pollution effects, Aldrin, Benz(a)anthracene, Benzanthracene, Benzopyrene, DDD, DDE, DDT, In vitro tests, Tissue analysis.

Established cell lines from brown bullhead catfish (BB) and rainbow trout (RTG-2) and primary cultures of cells derived from gill, fin, and gonad tissues from brown bullhead catfish were evaluated for use as bioindicators in the neutral red cytotoxicity assay. The BB and RTG-2 cells were compared after a 1 day exposure to chlorinated pesticides and after a 6 day exposure to various polycyclic aromatic hydrocarbons. The BB cells were more sensitive to both classes of chemicals. The sequence of toxicity for the BB cells was 4,4'-DDD, 4,4'-DDT > aldrin, 4,4'-DDE and 7,12-dimethylbenz(a)anthracene (DMBA) > 3-hydroxybenzo(a)pyrene (3-OH-B(a)P) > benzo(a)pyrene (B(a)P). For the RTG-2 cells, the sequence was aldrin > 4,4'-DDD > 4,4'-DDT > 4,4'-DDE and 3-OH-B(a)P > DMBA > B(a)P. The BB cells were also sensitive to benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, and trans-7,8-dihydro-7,8-dihydroxybenzo(a)pyrene. The responses of BB and RTG-2 cells were compared with those of primary cultures after a 1 day exposure to B(a)P. After 1 day of exposure, the RTG-2 cells and primary cultures were more sensitive than the BB cells to B(a)P. Apparently after 1 day of incubation the RTG-2 and primary cells metabolized greater amounts of B(a)P to cytotoxic metabolites than did the BB cells. However, by 6 days of incubation, the BB cells were more sensitive to B(a)P than were the RTG-2 cells. (Author's abstract)
W91-06781

TOXICITY TO ESTUARINE ORGANISMS OF LEACHATES FROM CHROMATED COPPER ARSENATE TREATED WOOD.
New Jersey Medical School, Newark. Dept. of Anatomy.
P. Weis, J. S. Weis, and L. M. Coohill.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 118-124, 1991. 3 fig, 4 tab, 16 ref.

Descriptors: *Arsenic compounds, *Bioassay, *Chromates, *Copper compounds, *Estuarine environment, *Leachates, *Toxicity, *Toxicology, *Water pollution effects, *Wood preservatives, Algae, Crabs, Heavy metals, Killifish, Mortality, Path of pollutants, Pesticide toxicity, Snails.

The effects of chromated copper arsenate (CCA), used for treating wood in docks, pilings, and bulkheads, were studied in several estuarine organisms. Leaching of metals from treated wood into sea water was assayed by atomic absorption spectrophotometry. Fiddler crabs (Uca pugilator) were subjected to limb removal and were placed in containers with treated wood of various sizes or control wood. Limb regeneration rate was retarded in a dose-dependent fashion and mortality occurred with the treated wood, reaching 100% in the tank with the largest piece of wood. Embryos of the mummichog (Fundulus heteroclitus) were allowed to develop in culture dishes in which CCA-treated or untreated wood was soaking. Mortality was noted in the dishes with treated wood and to a smaller extent in those with untreated wood. Containers having CCA-treated wood, control wood, or no wood were stocked first with the alga Ulva lactuca, then snails (Nassarius obsoletus). Chlorophyll content of the algae was reduced with the treated wood within a few days, and snails with the treated wood became moribund and died within a few days. In the controls containing untreated wood or no wood, no such effects were seen. Studies with individual or combinations of two or three of the metals with snails and algae indicated that the copper was primarily responsible for the snail mortality and algal bleaching was seen in the treated wood experiments. In all experiments, the toxicity of the wood decreased over time; when the experiments were repeated with the same pieces of wood, effects were diminished. (Author's abstract)
W91-06782

GENETIC DAMAGE IN A POPULATION OF SLIDER TURTLES (TRACHEMYS SCRIPTA) INHABITING A RADIOACTIVE RESERVOIR.
Savannah River Ecology Lab., Aiken, SC.
T. Lamb, J. W. Bickham, J. W. Gibbons, M. J. Smolen, and S. McDowell.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 138-142, 1991. 1 fig, 2 tab, 26 ref. US Dept. of Energy Contract DE-AC09-76SROO-819.

Descriptors: *Cesium radioisotopes, *Genotoxicity, *Mutagenicity, *Nuclear powerplants, *Radioactive wastes, *Strontium radioisotopes, *Turtles, *Water pollution effects, Animal pathology, Chronic effects, DNA, Mutagens, Population exposure, Reservoirs, Sublethal effects, Testing procedures, Tissue analysis, Toxicity.

One area of concern for which there remains virtually no data, is the effect of low-level radiation on natural biota following releases of radionuclides into the environment. Recent advances in flow cytometry (FCM) now permit the rapid, accurate measurement of DNA content from large numbers of cells, for a variety of tissues. In this study, turtles inhabiting a radioactive reservoir appeared to experience genetic damage due to environmental exposure to low concentrations of long-lived radionuclides. Total body burdens for 50 reservoir turtles examined in the survey ranged from 164.7 to 4679.3 Bq for cesium-137 and from 462.6 to 5098.3 Bq for strontium-90. FCM assays of red blood cell nuclei demonstrated significantly greater variation in DNA content for the reservoir turtles than for turtles from a nearby, non-radioactive site. Furthermore, two of the reservoir turtles possess FCM profiles that are indicative of aneuploid mosaicism. These data strongly suggest that exposure to low-level radiation may involve a sensitive genetic response in a natural population. (Author's abstract)
W91-06784

PROTECTION OF HUMAN HEALTH FROM MIXTURES OF RADIONUCLIDES AND CHEMICALS IN DRINKING WATER.
Oak Ridge National Lab., TN. Health and Safety Research Div.
T. D. Jones, B. A. Owen, and J. R. Trabalka.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 20, No. 1, p 143-150, 1991. 2 fig, 7 tab, 20 ref. US Dept. of Energy Contract DE-AC05-84OR21400.

Descriptors: *Drinking water, *Hazard assessment, *Model studies, *Public health, *Radioactive wastes, *Radionuclides, *Risk assessment, Data interpretation, Groundwater pollution, Human population, Model testing, Population exposure, Regulations, Test wells.

This study was undertaken to develop a common scale for evaluating health risks from contaminated drinking water. For different agents many unrealistic models of risk have been used. By intent, regulatory toxicology depends on 'data-sparse, model-intensive' analogies from exotic animal genetics and novel exposures. At least four methods having at least a similar number of hazard control levels (4x4) are currently used by rulemakers. Historical, regulatory methods were used, supplemented by additional data and methods to produce common scales. In this study, RADRISK was used as a model. This was developed for the EPA to estimate health risks from radionuclides. Relative comparisons were made in the manner of horsepower or RBE (radiation biological equivalent) from radiation biology. Next, relative potencies were linked to the most credible standards. Thus, experience was transferred from well-studied chemicals to the new chemical by 'data-intensive, model-sparse' methods. This logos provided much relative precision. Pollutants were then compared with: (1) common foodstuffs, (2) ambient radiation background, or (3) utility-pure drinking water. Finally, an assessment was made for a waste disposal area. Two groundwater samples from inside a radioactive low-level, solid waste disposal area (from Well T-92 and Well T-257), operated since 1968, were analyzed for pollutants. Measured concentrations at the site have been compared with EPA standards; 11 substances were above recommended levels. In contrast, GRAS-type (generally recognized as safe) comparisons suggested that only strontium-90 in Well T-92 would be a hazard above commonly accepted foods and utility pure water, even though levels were 400 times permissible concentrations calculated as the Hazard Index (used for exposure to multiple agents). (Author's abstract)
W91-06785

ECONOMICS OF NITRATE POLLUTION.
Stirling Univ. (Scotland). Dept. of Economics.
N. Hanley.
European Review of Agricultural Economics, Vol. 17, No. 2, p 129-151, 1990. 2 fig, 3 tab, 40 ref.

Descriptors: *Cost-benefit analysis, *Economic evaluation, *Environmental policy, *Nitrates, *Nonpoint pollution sources, *Soil contamination, *Water pollution sources, Environmental effects, Estimated costs, Eutrophication, Farm management, Fertilizers, Leaching, Nitrogen cycle, Path of pollutants, Public health, Water pollution control.

Nitrogen is essential to plant growth; however, excessive levels of nitrates in soil can cause environmental pollution. A review of the nitrogen cycle to and from the soil is presented along with an overview of the problems associated with nitrogen pollution in the environment. The seasonal pattern of nitrate leaching is particularly crucial. Leaching risks are highest when (1) rainfall is high,

(2) evaporation is low, and (3) crop demands are low. Health risks associated with hign nitrogen levels include methaemoglobinaemia (oxygen starvation in infants) and the formation of carcinogenic N-nitroso compounds. The primary environmental effect is eutrophication although some nitrogen fertilizers are volatilized and enter the atmosphere as ammonia. Methods for controlling excessive nitrate concentrations in the environment include reducing inorganic nitrogen fertilizer applications, reducing animal manure applications, and better management of direct nitrate applications. It is suggested that blanket restrictions on nitrate use, with standardized methods for achieving such restrictions, will not be economically practical in many cases. Methods such as tradeable permits, nitrogen taxes, the use of protection zones, and treatment are all options that must be evaluated based on case specific least cost option. (VerNooy-PTT)
W91-06790

3-D MAPPING OF DISSOLVED OXYGEN IN MAR PICCOLO: A CASE STUDY.
Support Group, Fremont, CA.
M. Rosse, and D. Poss.
Environmental Geology and Water Sciences EGWSEI, Vol. 16, No. 3, p 209-219, November/December 1990. 19 fig, 16 ref.

Descriptors: *Bays, *Data acquisition, *Dissolved oxygen, *Geostatistics, *Kriging, *Mapping, *Model studies, *Network design, *Statistical methods, *Water chemistry, *Water pollution effects, Algorithms, Contours, Data collections, Data interpretation, Italy, Rivers, Seawater, Spatial distribution, Statistical analysis, Statistical models, Variability.

The construction of a spatial model for several variables in the Mar Piccolo of Taranto, Italy, is important for understanding the effect that polluted streams entering the bay have on the saltwater environment. The current study discusses the geostatistical techniques used to interpolate dissolved oxygen (DO) values over a three-dimensional grid within the First Bay of the Mar Piccolo. The data sets were obtained during two sampling periods in March and November 1986. Particular attention was given to the definition of a variogram that would represent the spatial variability of DO values in the First Bay. First, a stationarity-in-time hypothesis was used to determine and model satisfactory experimental variograms. Second, the kriging algorithm implemented required a residual variogram model (i.e., a model not affected by the trend). The nonergodic variogram provided an estimator that filtered the trend observed in the data. Kriging with a trend model (KT) was implemented on a three-dimensional grid. The resulting contour maps generated by the model revealed low DO concentration values in a N-S trough along the west side of the basin corresponding to the presence of tidal currents. In addition, a low DO area was observed in the northern area of the bay, which spread over a significant volume of the First Bay. These low DO values were produced by known submarine springs in the area. (Korn-PTT)
W91-06802

GROWTH RESPONSES OF THREE LEGUME SPECIES EXPOSED TO SIMULATED ACID RAIN.
Institute of Terrestrial Ecology, Bangor (Wales). Bangor Research Station.
T. W. Ashenden, and S. A. Bell.
Environmental Pollution ENPOEK, Vol. 62, No. 1, p 21-29, 1990. 2 tab, 22 ref.

Descriptors: *Acid rain, *Acid rain effects, *Air pollution effects, *Legumes, *Plant growth, *Precipitation, *Simulated rainfall, Air pollution, Assimilative capacity, England, Growth kinetics, Growth rates, Hydrogen ion concentration, Seedlings.

In Britain, the acidity of rainfall is substantially increased by the presence of pollutants and there have been reports of sites in rural areas with monthly mean acidities as low as pH 3.4 and annual means down to pH 4.1. The effects of wet acid deposition on vegetation was studied by exposing seedlings of Vicia faba L., Phaseolus multiflorus L., and Pisum sativum L. to simulated rainfall treatments under pH values of 5.6, 4.5, 3.5, and 2.5. Simulated rainfall amounts totaled 30 mm per week. All three species were found to be adversely affected by the more acid pH treatments (i.e., pH 3.5 and 2.5) after 7-8 weeks of exposure. There were total plant dry weight reductions of 40% for V. faba, 31% for P. sativum, and 28% for P. multiflorus exposed to the pH 2.5 treatment, as compared to those grown in the control (pH 5.6 treatment). In addition, V. faba was found to be sensitive to the pH 4.5 treatment with an 18% reduction in total plant weight (compared to plants grown in the pH 5.6 treatment). In P. multiflorus, reduction in the dry weights of shoots in response to increasing acidity of rain was not accompanied by reduction in root weights, indicating an interference in the partitioning of assimilates. It is concluded that these three species, and V. faba in particular, may be growing below their potential in much of the United Kingdom. (Author's abstract)
W91-06804

EFFECT OF CHROMIUM (VI) ON ACTIVATED SLUDGE.
Middle East Technical Univ., Ankara (Turkey). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W91-06866

CHRONIC AND SUBLETHAL TOXICITIES OF SURFACTANTS TO AQUATIC ANIMALS: A REVIEW AND RISK ASSESSMENT.
Battelle, Columbus, OH. Environmental Biology and Assessment.
M. A. Lewis.
Water Research WATRAG, Vol. 25, No. 1, p 101-113, January, 1991. 2 fig, 5 tab, 105 ref.

Descriptors: *Aquatic animals, *Ecological effects, *Risk assessment, *Surfactants, *Toxicity, *Water pollution effects, Behavior, Benthic fauna, Bioassay, Detergents, Fathead minnows, Larval growth stage, Linear alkyl sulfonates, Reproduction, Reviews, Water quality control.

Surfactants are one of the major components (10-18%) of detergent and household cleaning products, and they are used in high volumes. The chronic and sublethal toxicities of commercially important surfactants commonly found in natural waters on aquatic animal life are reviewed to present a comprehensive summary of these effects for commercially important surfactants on freshwater and seawater animal life. Historically, the effects of anionic ABS (alkylbenzene sulfonate) and LAS (linear alkylbenzene sulfonate) have been the primary focus of scientific investigations concerning environmental safety. Cationic surfactants, such as ditallow dimethyl ammonium chloride (DTDMAC), have not received the attention they deserve. Chronic toxicity of anionic and nonionic surfactants occurs at concentrations usually greater than 0.1 mg/L. Behavioral and physiological effects on avoidance, reproduction, larval growth and development for these same compounds occur over a range of concentrations from 0.002-40.0 mg/L. The available toxicity data base is largely comprised of laboratory-derived toxicity studies for a few surfactants (LAS) and single freshwater species, viz. Daphnia, fathead minnows, and benthic midge. Effects on saltwater species and natural biotic communities are largely unknown for many commercially important surfactants. The toxicity data base for cationic surfactants needs to be expanded since these compounds appear to be the most toxic, while LAS appears to be the least. Safety assessments for other major surfactants in saltwater and freshwater should be considered preliminary and limited until validated with corresponding exposure measurements and additional laboratory and field-derived chronic toxicity data for animal test species. (Doyle-PTT)
W91-06871

CHEMISTRY OF ATMOSPHERIC PRECIPITATION AT THE WESTERN ARABIAN GULF COAST.
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
A. F. M. Ahmed, R. P. Singh, and A. H. Elmubarak.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 2927-2934, 1990. 3 fig, 4 tab, 34 ref.

Descriptors: *Acid rain, *Atmospheric chemistry, *Chemistry of precipitation, *Persian Gulf, *Saudi Arabia, *Water chemistry, Acidic water, Acidity, Ammonium, Anions, Bicarbonates, Buffering, Calcium, Cations, Chlorides, Hydrogen ion concentration, Ion chromatography, Magnesium, Mass balance, Nitrates, Nitrites, Potassium, Spectrometry, Strontium, Sulfates, Suspended solids.

Rainwater and atmospheric bulk deposition samples were collected at a station in Dhahran continuously throughout the rainy season between December 1987 and February 1988, and for one rainfall event in March 1987. A total of 13 samples were collected and investigated for pH and dissolved ionic composition using inductivity coupled plasma emission spectrometry (ICP) and ion chromatography (IC). The range and volume-weighted average pH were 5.1 to 7.2 and 5.48, respectively. Significant negative linear correlations were observed between the precipitation pH and rain depth, and between pH and the summation of dissolved (calcium + magnesium ions) minus (sulfate + nitrate + nitrite ions). The ionic summation also correlated negatively with rain depth. The ionic abundance in rainwater expressed in concentration order showed the general trend sulfate > bicarbonate > chloride > nitrate > nitrite for anions and Ca > Na > Mg > ammonium > K > H > Sr for cations. Good mass balance between cations and anions was observed. Total nitrates and sulfates contribute equally to precipitation acidity. Ca plus Mg in alkaline suspended particulates from natural sources are the major ions that buffer the acidity of precipitation. Ammonium ion plays an insignificant role in the acid/base equilibrium of rainwater. (Author's abstract)
W91-06873

CONFIRMATION AND QUANTITATION OF HYDROXYMETHANESULFONATE IN PRECIPITATION BY ELECTROSPRAY IONIZATION-TANDEM MASS SPECTROMETRY.
Battelle Pacific Northwest Labs., Richland, WA.
E. G. Chapman, C. J. Barinaga, H. R. Udseth, and R. D. Smith.
Atmospheric Environment Part A: General Topics AEATEN, Vol. 24, No. 12, p 2951-2957, 1990. 4 fig, 1 tab, 19 ref. DOE Contract DE-AC06-76RLO 1830.

Descriptors: *Acid rain, *Air pollution, *Analytical methods, *Chemistry of precipitation, *Hydroxymethanesulfonate, *Mass spectrometry, Anions, Cloud liquid water, Fog, Nitrates, Precipitation, Sulfates, Sulfites, Sulfur, Sulfur compounds, Water analysis.

Hydroxymethanesulfonate (HMS), an adduct formed by the reaction of dissolved SO2 and formaldehyde, was initially postulated to exist in precipitation based only on circumstantial evidence because of the limitations of previous analytical methods. The technique of electrospray ionization-mass spectrometry (ESI-MS) was used to definitively identify and quantify this species in five of six selected precipitation samples from New York, Pennsylvania, Illinois, and Ohio. In the ESI-MS analyses, HMS showed a distinct fragmentation pattern upon collisionally induced dissociation, with major peaks at m/z 17, 80, and 81 corresponding to the OH(-), SO3(-), and HSO3(-) ions. Analyses of laboratory-prepared solutions indicated an analytical precision of approximately plus or minus 10% for HMS, with quantitative detection limits likely to be in the range of 0.01 microM or below. Concentrations of HMS in the five precipitation samples ranged from 0.6 to 8.6 microM with contributions to total sulfur ranging from 3.4% to 22%. Other precipitation anions, such as SO4(2-) and NO3(-), were easily identified in the ESI-MS analyses. The results of this study suggest that the ESI-MS technique has great potential in the analy-

sis of a broad spectrum of atmospheric compounds, particularly in cloud and fog water samples where limited collection volumes are available. (Author's abstract)
W91-06874

ACUTE TOXICITIES TO LARVAL RAINBOW TROUT OF REPRESENTATIVE COMPOUNDS DETECTED IN GREAT LAKES FISH.
National Fisheries Research Center-Great Lakes, Ann Arbor, MI.
C. C. Edsall.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 173-178, February 1990. 2 tab, 11 ref.

Descriptors: *Acute toxicity, *Fish larvae, *Great Lakes, *Hydrocarbons, *Pesticide toxicity, *Toxicology, *Trout, *Water pollution effects, Dissolved oxygen, Herbicides, Insecticides, Mortality, Polycyclic aromatic compounds, Solubility, Statistical analysis, Temperature, Toxicity.

Static acute toxicity tests were conducted using larval rainbow trout (Oncorhynchus mykiss) as the test fish. Four classes of compounds were tested: polycyclic aromatic hydrocarbons (PAH), alkyl halides, cyclic alkanes, and heterocyclic nitrogen compounds. The calculated median lethal concentrations were predominantly in the moderately toxic range; the calculated LC50 of the alkyl halide 1-bromodecane (18.7 mg/L) would put that compound in the slightly toxic range; statistical analysis indicated that 1-bromodecane was significantly less toxic than the other compounds. The analysis also indicated that the cyclic alkane cis-1,2-dimethylcyclohexane (LC50 7.1) was less toxic than the PAH compound 1,3-dimethylnaphthalene (LC50 1.7), but there were no differences between any of the other compounds. The statistical differences are probably not ecologically significant. Solubility of the compounds in water should be considered when comparing LC50s. The solubility of 1-bromodecane in water was significantly lower than that of the other compounds tested. Therefore, a wider range of concentrations was tested before the LC50 was calculated, and all the fry that did not die were physically stressed. Hence, 1-bromodecane was more toxic to fry than the LC50 results indicated. (Doria-PTT)
W91-06882

EFFECTS OF LINDANE AND ACETONE ON THE DEVELOPMENT OF LARVAE OF THE SOUTHERN KING CRAB (LITHODES ANTARCTICUS JAQUINOT).
Buenos Aires Univ. (Argentina). Dept. Ciencias Biologicas.
R. J. Lombardo, L. Ferrari, and J. H. Vinuesa.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 185-192, February 1990. 3 fig, 2 tab, 17 ref.

Descriptors: *Acetone, *Crabs, *Growth, *Lindane, *Organochlorine pesticides, *Pesticides, *Solvents, *Water pollution effects, Animal physiology, Crustaceans, Larval growth stage, Lipids, Mortality, Organophosphorus pesticides, Salinity, Seawater, Survival, Toxicity.

The effects of lindane and its most commonly used solvent (acetone) were determined on survival, development, and molting of the early larval stages of Lithodes antarcticus. Lindane was tested in concentrations ranging from 0.10 to 5.60 mg/L. Higher concentrations of lindane produced an abrupt rise in mortality between 48 and 96 h of culture, while lower concentrations produced a more gently sloping mortality curve between 96 and 168 h. An exponential decrease of LC50 values was observed during the development time of the first zoeal stage. This asymptotic trend with exposure time indicates an incipient lethal level under 94 micrograms/L; at this concentration acute toxicity ceases. Mortality during the first larval stage could considerably affect the percentage of individuals completing larval development. The mortality curve of larvae exposed to 0.75 g/L acetone (acetone controls) did not differ from that of seawater controls. However, acetone has an inhibiting effect on molting which is more marked with increasing acetone concentrations. Lindane strongly inhibited the molting process; no larvae succeeded in molting to second zoeae under any of the tested lindane concentrations. (Doria-PTT)
W91-06884

NEW TOXICITY TESTING METHOD USING MARINE BACTERIVOROUS NANOFLAGELLATES.
Biologische Anstalt Helgoland (Germany, F.R.)
K. Poremba.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 193-196, February 1990. 1 tab, 7 ref.

Descriptors: *Analytical methods, *Bioassay, *Bioindicators, *Flagellates, *Protozoa, *Toxicity, *Toxicology, Bioluminescence, Growth, Growth media, Heavy metals, Marine bacteria, Microscopic analysis, Population density, Water pollution effects.

A modified growth inhibition test for marine toxicological studies was devised using bacterivorous nanoflagellates. The test is based on the fact that bacteria required for the growth of the test organism are less sensitive to low concentrations of chemicals. A small population of about 100 flagellates per ml grows into a dense population of a million or more per ml if a sufficient threshold concentration of bacteria (about 10 million per ml) is present. A dense flagellate population is easily detected by microscopic examination in a counting chamber. The propagation of flagellates can be inhibited by toxicant concentrations too low to hinder bacterial growth. The method was tested using a mixed flagellate culture and several toxicants, including heavy metals, surfactants, and phenol. Results were similar to those obtained with other methods (bioluminescence inhibition of Photobacterium phosphoreum and brine shrimp mortality). It is concluded that the present test is a useful complement to existing methods, measuring a clearly toxic effect on an important organism of the ecosystem. A significant advantage is that it is easy and inexpensive to perform. There is no need to maintain sterile conditions, since bacteria in the test medium are necessary for propagation of the test organism. (Doria-PTT)
W91-06885

CHANGES IN THE TOXICITY OF THREE PESTICIDES AS A FUNCTION OF ENVIRONMENTAL PH AND TEMPERATURE.
Ohio State Univ., Columbus. Dept. of Entomology.
S. W. Fisher.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 197-202, February 1990. 3 tab, 17 ref.

Descriptors: *Acid rain effects, *Acidity, *Bioassay, *Midges, *Pesticide toxicity, *Temperature effects, *Toxicology, *Water pollution effects, Aldicarb, Animal physiology, Benzene hexachloride, Bioaccumulation, Degradation, Fate of pollutants, Hydrogen ion concentration, Larval growth stage, Pentachlorophenol, Respiration, Solvents, Water quality.

Accurate predictions of pesticide fate and toxicity in aqueous environments are hindered by lack of information on how site-specific water quality parameters affect the biological activity of these compounds. Therefore, the influence of simultaneous variation in pH and temperature on the toxicity of three pesticides, pentachlorophenol (PCP), aldicarb, and benzene hexachloride (BHC), was studied. The test organism was fourth-instar midge larvae (Chironomus riparius). Variations in pH and temperature significantly affected the toxicity of the three pesticides. When the two parameters were varied simultaneously, the results were frequently different from when a single factor was varied. The most striking example was PCP. An increase of pH from 4 to 8 was associated with a dramatic decrease in toxicity, attributable to ionization of PCP as pH goes up. As temperature rose from 15 C to 35 C, toxicity of PCP increased significantly at all three pH levels tested; the reason for this increase is not clear. Changes in toxicity as a function of environmental parameters for aldicarb and BHC were less clear than for PCP, although interactions between pH and temperature were evident. These data emphasize the importance of environmental variables in determining the toxicity of pesticides and suggest that for some chemicals a hazard assessment would be incomplete unless key site-specific variables are analyzed for their influence on toxicity, both individually and in concert with other water quality parameters. (Doria-PTT)
W91-06886

POLLUTED WATER CONCENTRATES: INDUCTION OF GENETIC ALTERATIONS IN SACCHAROMYCES CEREVISIAE D7 STRAIN.
Buenos Aires Univ. (Argentina). Dept. of Toxicology.
J. Moretton, P. Baro, A. Zelazny, and M. D'Aquino.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 203-207, February 1990. 1 tab, 7 ref.

Descriptors: *Bioassay, Sample preparation, *Genetic pollution, *Genotoxicity, *Mutagenicity, *Pollutant identification, *Saccharomyces, *Water analysis, *Water pollution effects, *Yeasts, Industrial wastes, Mutagens, Pesticides, Resins, Rivers, Sampling, Stream pollution, Water pollution.

The concentration of mutagenic pollutants using XAD resins allows the identification of biohazardous fractions to be submitted for further analysis. In this experiment, the genotoxic potential of XAD2 concentrates of samples from a heavily polluted stream were evaluated by the induction of gene conversion and point mutation in Saccharomyces cerevisiae D7. Surface river samples were collected from three sampling locations within the industrial area near Buenos Aires and passed through an XAD2 resin column. Genotoxic effects were considered positive when the experimental frequencies exceeded those of the controls at least twofold. All the concentrates tested showed a positive response in gene conversion induction. These results give a clear idea of the contamination degree in the samples examined. Concentrates from one sample showed a clear positive response after 24 h incubation. This response was associated with a fall in the survival of the yeast for the XAD2 pH 7-7.4 concentrate but not for the acidic one. The other two samples showed a genotoxic response after 4 h incubation. A slight toxic response, not associated with genotoxicity, was detected when a pure concentrate of one sample was assayed. None of the samples showed induction of mitotic reversion. (Doria-PTT)
W91-06887

ACUTE TOXICITY OF PCB CONGENERS TO DAPHNIA MAGNA AND PIMEPHALES PROMELAS.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
T. M. Dillon, and W. D. S. Burton.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 208-215, February 1990. 1 fig, 3 tab, 21 ref.

Descriptors: *Acute toxicity, *Fathead minnows, *Polychlorinated biphenyls, *Toxicity, *Toxicology, *Water pollution effects, Analysis of variance, Aquatic animals, Growth stages, Larval growth stage, Solvents, Survival.

Because PCBs are very hydrophobic, most biological studies have utilized a carrier solvent to facilitate introduction of PCBs into aqueous solution. Therefore, a study was undertaken to evaluate the comparative toxicity of selected PCB congeners without carrier solvents. These tests were conducted on early life stages of two sensitive freshwater organisms, Daphnia magna and Pimephales promelas. Mean percent survival of Daphnia magna exposed for 48 h under static conditions to 9 PCB congeners was high and ranged from 97% to 100%. However, Daphnia survival was significantly lower (53%) in the 100% saturated solution of the lowest chlorinated PCB tested, congener 18.

Fish survival was high (93%-100%) in all PCB treatments except congener 18, where only 17% of the animals were alive after 96 h in the 100% saturated solution. Results of the static-renewal tests were not appreciably different from the static tests. Survival was very high for both Daphnia and Pimephales exposed to all PCBs except congener 18. Fathead minnow fry appear to be slightly more sensitive to congener 18 than Daphnia neonates. Additional toxicity tests conducted without carrier solvents are needed to determine whether the high toxicity of congener 18 is related to molecular weight or is a phenomenon unique to that congener. (Doria-PTT)
W91-06888

LONG TERM EFFECTS OF CRUDE OIL ON COMMON MURRES (URIA AALGE) FOLLOWING REHABILITATION.
Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
R. A. Khan, and P. Ryan.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 216-222, February 1990. 16 ref.

Descriptors: *Animal pathology, *Oil pollution, *Oil spills, *Sublethal effects, *Tissue analysis, *Water birds, *Water pollution effects, Animal physiology, Aquatic life, Cleanup operations, Histology, Kidneys, Liver, Marine animals, Metabolism, Newfoundland, Oil.

Fifteen seabirds (13 common murres, Uria aalge, and two thick-billed murres, U. lomvia) lightly to moderately contaminated with crude oil primarily on the breast, wings, feet, and head, were retrieved January 18 to 22, 1990 near Gooseberry Cove, Newfoundland, and transported to a rehabilitation center. One common and one thick-billed murre were successfully rehabilitated and released. Most of the remaining birds were necropsied to determine the long-term effects of the oil. All birds lost weight continually following retrieval. Examination of tissue sections revealed histopathological changes in the liver, kidneys, and intestines of all birds. The most common lesion observed in the liver was necrosis. Congestion of the liver, fatty degeneration, and dissociation of hepatocytes were apparent each in one bird. There was evidence of pigment accumulation in hepatocytes and Kupffer cells of all birds. Renal tubular degeneration and necrosis were present in all birds. There was also extensive necrosis in the duodenum. Some of the observations in this study are consistent with reports that contamination of seabirds with crude oil or its byproducts causes weight loss and histopathological changes. It is likely that ingestion of crude oil caused multiple sublethal effects that disrupted metabolism and ultimately culminated in debility, death, or both of the common murres. (Doria-PTT)
W91-06889

GROWTH RESPONSE OF FRESHWATER ALGAE, ANABAENA FLOS-AQUAE AND SELENASTRUM CAPRICORNUTUM TO ATRAZINE AND HEXAZINONE HERBICIDES.
National Research Centre, Cairo (Egypt). Water Pollution Control Lab.
H. Abou-Waly, M. M. Abou-Setta, H. N. Nigg, and L. L. Mallory.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 223-229, February 1990. 4 tab, 22 ref.

Descriptors: *Algal growth, *Anabaena, *Atrazine, *Chronic toxicity, *Herbicides, *Hexazinone, *Pesticide toxicity, *Selenastrum, *Toxicology, *Water pollution effects, Algae, Analysis of variance, Chlorophyll a, Chlorophyta, Cyanophyta, Fluorometry, Spectrophotometry.

The toxicity of atrazine and hexazinone to Anabaena flos-aquae and Selenastrum capricornutum was measured by chlorophyll a content and dry weight. S. capricornutum was more susceptible to hexazinone than atrazine. The EC50 values generally increased with time, while the slopes for the relation between growth and herbicide concentration declined over time. Reduction in growth was observed with an increase of atrazine concentration. Hexazinone-treated cultures of S. capricornutum had substantially recovered by 7 d after treatment. The first day showed a sharp decrease in the growth rate of chlorophyll a content with an increase in herbicide concentration as compared to the growth rate of the control culture. On the third day, algal cells displayed a higher growth rate. This indicates that the herbicide may have had an algistatic effect, and the algal cells recovered their normal vitality after 3 d of exposure. The pattern of growth rate differences of both tested organisms over time was fairly consistent. Using repeated measurement analysis of variance for the growth rates over time and concentrations revealed statistically significant importance for both factors. Because of the negative values of the growth rate, especially at higher concentrations after one day of exposure, and the ability of the algae to recover with time, the effect of herbicides on algae may be more accurate if determined at least 3 d after exposure. (Doria-PTT)
W91-06890

INHIBITION OF CORNEAL EPITHELIAL CELL MIGRATION BY CADMIUM AND MERCURY.
Mount Desert Island Biological Lab., Salsbury Cove, ME.
J. L. Ubels, and T. B. Osgood.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 230-236, February 1990. 3 fig, 19 ref. NIH Grants P30 ES0283 and T35 GM07892.

Descriptors: *Animal physiology, *Cadmium, *Heavy metals, *Mercury, *Sculpin, *Water pollution effects, Dose-response relationships, Fish, Gulf of Maine, Maine, Metal complexes, Regression analysis, Toxicity.

Longhorn sculpin (Myoxocephalus octodecimspinosus) from the Gulf of Maine were used to study the effect of cadmium and mercury on epithelial migration in the cornea, an important component of corneal wound healing. Exposure of corneas with wounds 7 mm in diameter to CdCl2 for 12 h resulted in a dose-dependent inhibition of cell migration. At 0.1 microM no inhibition of healing was observed while at 0.00001 M the healing rate was reduced to 2.43 sq mm/h compared to a control rate of 5.57 sq mm/h. Cell migration stopped after 9 h exposure to 0.00001 M CdCl2. Studies using video microscopy suggest that cadmium interferes with processes that initiate wound healing and that it is not able to stop a cell that has begun to migrate. Inorganic mercury (HgCl2) or methyl mercury also inhibited corneal epithelial cell migration in a dose-dependent manner. At 0.1 microM HgCl2 was not toxic, while at 0.00001 M the healing rate was reduced to 2.1 sq mm/h compared to a control rate of 5.3 sq mm/h. Methyl mercury did not inhibit healing at 1 microM, but the healing rate was reduced to 3.2 sq mm/h by 0.00001 M methyl mercury compared to a control rate of 4.7 sq mm/h. Methyl mercury also caused cell sloughing with wounds enlarging by 12 h. It is apparent that HgCl2 is toxic to corneal epithelium at a lower concentration than methyl mercury. It is concluded that cadmium and mercury may cause developmental anomalies related to epithelial cell migration. (Doria-PTT)
W91-06891

EFFECTS OF PARAQUAT AND LEAD ON FISH OREOCHROMIS HORNORUM.
Instituto Politecnico Nacional, Mexico City. Dept. de Farmacologia y Toxicolgia.
G. S. Arias, L. Martinez-Tabche, and I. Galar.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 46, No. 2, p 237-241, February 1990. 2 tab, 11 ref. DEPI-IPN Grant 896772, CONACYT 892347, and Fondo R. Zevada 79/89.

Descriptors: *Lead, *Paraquat, *Tilapia, *Toxicity, *Toxicology, *Water pollution effects, Animal physiology, Bioassay, Enzymes, Fish behavior, Gills, Herbicides, Liver, Median tolerance limit, Mexico, Mortality, Pesticide effects.

Tilapia (Oreochromis hornorum) collected from a fish farm in Zacatepec, Mexico, and exposed to lead and paraquat. LC50s for lead and paraquat were 202 mg/L and 31/5 mg/L respectively. Fish treated with paraquat had a tendency to swim erratically near the water surface, and lead-treated fish showed a loss of equilibrium. Paraquat induced the formation of lipid peroxides in gills and liver at all concentrations. Fish exposed only to lead (47 mg/L) also exhibited lipid peroxidation in both gills and liver. However, at the lowest paraquat concentration (0.1 mg/L) plus lead, lipid peroxidation diminished approximately to control levels. At higher paraquat concentrations (10.5 and 21.0 mg/L) plus lead, lipid peroxidation increased significantly. The fact that fish exposed simultaneously to lead (47 mg/L) and paraquat (0.1 mg/L) resulted in a diminution of lipid peroxidation suggests an antagonism between these two compounds under these conditions. Effects on lipid peroxidation were more severe in liver than in gills. Exposure to 21 mg/L of paraquat resulted in an increase of gill carbonic anhydrase activity, but this effect was not observed when lead was present. (Doria-PTT)
W91-06892

CHLORINATION OF DRINKING WATER AND CANCER.
Calcutta Municipal Corp. (India).
For primary bibliographic entry see Field 5F.
W91-06898

EFFECT ON MUTAGENICITY OF THE STEPWISE REMOVAL OF HYDROXYL GROUP AND CHLORINE ATOMS FROM 3-CHLORO-4-(DICHLOROMETHYL)-5-HYDROXY-2(5H)-FURANONE: 13C NMR CHEMICAL SHIFTS AS DETERMINANTS OF MUTAGENICITY.
State Univ. of New York, Syracuse. Coll. of Environmental Science and Forestry.
R. T. LaLonde, G. P. Cook, H. Perakylan, and C. W. Dence.
Chemical Research in Toxicology CRTOEC, Vol. 4, No. 1, p 35-40, January/February 1991. 3 fig, 2 tab, 25 ref. U.S. Geological Survey Award 14-08-0001-G1498.

Descriptors: *Chlorination, *Chlorine, *Mutagenicity, *Mutagens, *Structure-activity relationships, *Toxicology, *Water pollution effects, Assay, Disinfection, Drinking water, Furanones, Nuclear magnetic resonance, Salmonella.

The response of mutagenicity to the stepwise replacement of chlorine atoms and the hydroxyl group by hydrogen in 3-chloro 4-(dichloromethyl) 5-hydroxy 2(5H)-furanone (MX,1) was determined in several assays using Salmonella typhimurium strain TA100. MX is a direct acting mutagen that has been identified in softwood kraft chlorination effluent, chlorinated humic waters, and some chlorine-disinfected drinking waters. In all, eight MX derivatives were assayed. Several were studied together in at least one assay. In addition to MX, the seven included 3-chloro 4-(dichloromethyl) 2(5H)-furanone (RMX, 2), 3-chloro 4-(chloromethyl) 5-hydroxy 2(5H)-furanone (3), 3-chloro 4-(chloromethyl) 2(5H)-furanone (4), 4-(chloromethyl) 5-hydroxy-2(5H)-furanone (5), 4-chloromethyl 2(5H)-furanone (6), and 4-(dichloromethyl) 2(5H)-furanone (8). Compounds 1-6 were mutagenic. Compound 8 gave erratic results. 4-(Acetoxymethyl) 2(5H)-furanone was nonmutagenic. The largest drop in mutagenicity amounted to a factor of about 100 for the replacement of the hydroxyl group or a C-3 chlorine atom from 3. Other replacements of the hydroxyl group or a C-3 or C-6 chlorine atom amounted to mutagenicity diminished by a factor of only 10. On the basis of the rates of UV spectral changes under assay conditions, chemical half-life values for 1-6 and 8 were estimated as indicators of compound stability. However, mutagenicity differences were shown to result principally from the intrinsic mutagenicities of the six compounds 1-6 rather than from differences in stability. Plots of mutagenicity against the C13 chemical shifts for C-2, C-3, and C-4 in compounds 1-6 resulted in each case in a linear dependency. Plots of mutagenicity against the C13 chemical shifts C-2 and C-4 had negative slopes. The plot

of mutagenicity against the C13 chemical shift C-3 gave a positive slope. The correlations were attributed to the dependence of mutagenicity on electron density at C-2, C-3, and C-4. (Author's abstract)
W91-06910

REACTIONS OF AQUEOUS CHLORINE IN VITRO IN STOMACH FLUID FROM THE RAT: CHLORINATION OF TYROSINE.
Old Dominion Univ., Norfolk, VA. Dept. of Chemistry and Biochemistry.
M. G. Nickelsen, A. Nweke, F. E. Scully, and H. P. Ringhand.
Chemical Research in Toxicology CRTOEC, Vol. 4, No. 1, p 94-101, January/February 1991. 5 fig, 3 tab, 36 ref. Environmental Protection Agency Agreement CR-810459.

Descriptors: *Amino acids, *Chlorination, *Chlorine, *Drinking water, *Toxicity, *Toxicology, *Water pollution effects, Animal physiology, Aromatic compounds, Disinfection, Hydrogen ion concentration, Rats.

Aqueous chlorine reacts with tyrosine found in stomach fluid to form ring-chlorinated products. Ring substitution occurs at Cl:tyrosine mole ratios less than 1. Because the nitrogen function of amides is much less reactive than that of amines, the aromatic ring of N-acetyltyrosine is chlorinated at chlorine:substrate mole ratios less than 1. When an aqueous solution of the gastric protein pepsin was chlorinated (37 C, 45 min), tyrosine residues were chlorinated at pH 2 but not at pH 8. The carbohydrate, protein, and chloride concentrations in stomach fluid from fasted rats were determined. When varying concentrations of aqueous chlorine (20-180 mg/L) were added to the stomach fluid at pH 2, tyrosine residues were mono-, and dichlorinated on the aromatic ring. The amount of mono-to dichlorination products varied with the concentration of aqueous chlorine. A mechanism is proposed whereby the chlorination reaction of the amino nitrogen was much faster than the chlorination reaction of the side-chain aromatic groups. At pH 2 the fraction of free amino groups is approximately 100,000 lower than at pH 7 and consequently the rate of reaction is proportionally slower. Also in stomach fluid the concentration of chloride ion is high favoring the rapid chlorination of the aromatic compound. Since the products of the chlorination of tyrosine are dependent on the concentration of aqueous chlorine used, the toxicological responses observed at higher chlorine concentrations may not reflect the true toxicological effects of concentrations found in drinking water. (Author's abstract)
W91-06911

HEALTH OF LATIN AMERICANS EXPOSED TO POLLUTED RIVERS: A TRIPLE-BLIND OBSERVATIONAL STUDY.
International Journal of Epidemiology IJEPBF, Vol. 19, No. 4, p 1091-1099, December 1990. 7 tab, 9 ref.

Descriptors: *Developing countries, *Path of pollutants, *Public health, *Rivers, *South America, *Trace metals, *Water pollution effects, Arsenic, Blood, Bolivia, Drinking water, Epidemiology, Industrial wastes, Lead, Mercury, Nutrition, Research priorities, Statistical analysis, Surveys, Urine.

A cross-sectional survey was conducted simultaneously in 6 Latin American nations among people living near a river in each country known to be polluted. Trace metals (arsenic, mercury, and lead) served as indicators of exposure to industrial effluents. Outcome variables were health status measurements elicited by questionnaire and biochemical measures of blood and urine. Several possible explanatory and confounding variables were examined, including housing conditions, nutrition, and source of drinking water. The field work was done with triple blinding in that data gatherers and study subjects were unaware of their group membership and of the study hypotheses, those analyzing specimens and questionnaires were blind to country and community origin, and the investigators reviewed the results in code. Methods were carefully standardized across 6 countries. There were 900 eligible subjects from 18 communities; the overall response rate was 92%. Results showed an acceptable level of health in all communities and no relationship to exposure. Levels of trace metals were largely normal although one cluster of children with high mercury was found in Bolivia. Lead levels in children in 4 countries were high enough to recommend surveillance. Six national teams able to work separately or as a multicenter group are now ready to respond to research challenges that concern the environment and community health in Latin America. (Author's abstract)
W91-06916

EFFECTS OF MEASUREMENT ERROR ON PREVIOUSLY REPORTED MATHEMATICAL RELATIONSHIPS BETWEEN INDICATOR ORGANISM DENSITY AND SWIMMING-ASSOCIATED ILLNESS: A QUANTITATIVE ESTIMATE OF THE RESULTING BIAS.
State Univ. of New York at Brooklyn.
For primary bibliographic entry see Field 7C.
W91-06917

BEHAVIORAL REACTIONS FOR THE ASSESSMENT OF STRESS IN FISHES.
North Texas State Univ., Denton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W91-06919

REVIEW OF BIOCHEMICAL METHODS AND OTHER INDICATORS TO ASSESS FISH HEALTH IN AQUATIC ECOSYSTEMS CONTAINING TOXIC CHEMICALS.
Department of Fisheries and Oceans, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W91-06920

WHOLE-ANIMAL PHYSIOLOGICAL PROCESSES FOR THE ASSESSMENT OF STRESS IN FISHES.
North Texas State Univ., Denton. Dept. of Biolcgical Sciences.
For primary bibliographic entry see Field 5A.
W91-06921

CRITICAL APPRAISAL OF POPULATION APPROACHES IN ASSESSING FISH COMMUNITY HEALTH.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W91-06922

USING LAKE TROUT AS A SURROGATE OF ECOSYSTEM HEALTH FOR OLIGOTROPHIC WATERS OF THE GREAT LAKES.
North Central Forest Experiment Station, Rhinelander, WI. Forestry Sciences Lab.
For primary bibliographic entry see Field 5A.
W91-06923

CHALLENGES IN THE DETECTION AND DIAGNOSIS OF PATHOLOGICAL CHANGE IN AQUATIC ECOSYSTEMS.
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W91-06924

ECOSYSTEM HEALTH, A HUMAN PERCEPTION: DEFINITION, DETECTION, AND THE DICHOTOMOUS KEY.
Ontario Ministry of Natural Resources, Thunder Bay. Fisheries Research Section.
For primary bibliographic entry see Field 5G.
W91-06925

NEW STRATEGIES FOR GREAT LAKES TOXICOLOGY.
International Joint Commission-United States and Canada, Windsor (Ontario).
For primary bibliographic entry see Field 5A.
W91-06926

FISH COMMUNITY HEALTH ASSESSMENT: A USEFUL CONCEPT.
Institut Maurice-Lamontagne, Mont-Joli (Quebec).
For primary bibliographic entry see Field 5A.
W91-06927

COMMENTARY ON FISH COMMUNITY HEALTH: MONITORING AND ASSESSMENT IN LARGE LAKES.
Case Western Reserve Univ., Cleveland, OH. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W91-06928

DETERMINING THE HEALTH OF FISH COMMUNITIES: PARALLELS WITH HUMAN MEDICINE.
Wilfrid Laurier Univ., Waterloo (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W91-06929

OBSERVATIONS ON FISH COMMUNITY HEALTH.
Environmental Protection Agency, Chicago, IL. Great Lakes National Program Office.
For primary bibliographic entry see Field 5A.
W91-06930

DEVELOPMENT OF A TOXIC ALEXANDRIUM MINUTUM HALIM (DINOPHYCEAE) BLOOM IN THE HARBOUR OF SANT CARLES DE LA RAPITA (EBRO DELTA, NORTHWESTERN MEDITERRANEAN).
Instituto de Ciencias del Mar, Barcelona (Spain).
For primary bibliographic entry see Field 5B.
W91-06938

EFFECT OF CRUDE OIL ON DENITRIFICATION AND SULFATE REDUCTION IN MARINE SEDIMENTS.
Centre d'Oceanologie de Marseille (France).
P. Bonin, M. Gilewicz, E. Rambeloarisoa, G. Mille, and J. C. Bertrand.
Biogeochemistry BIOGEP, Vol. 10, No. 2, p 161-174, 1990. 5 fig, 4 tab, 20 ref.

Descriptors: *Denitrification, *Hydrocarbons, *Marine sediments, *Oil pollution, *Sulfur compounds, *Water pollution effects, Analytical methods, Anoxic conditions, Bacterial physiology, Chemical properties, Lactates.

The effects of a high level of hydrocarbon pollution on denitrification were studied. The denitrifying activity was measured in different types of sediment from the Mediterranean coast of France before, and after a massive contamination (30-100 g/kg sediment) of hydrocarbons. Analytical assays were used to determine the physical, chemical and bacterial characteristics of the sediment. A closed system was used in order to maintain anoxic conditions and to control substrates and gascous product concentrations. Results demonstrated that the respiratory metabolism was inhibited in all cases following an incubation time of 20 to 50 days. The restoration of denitrification after the addition of lactate suggests a deficiency of some organic substrates preferentially used by sulfate-reduction and/or fermentation bacteria. Lactate, a non-fermentable substrate was used at 3 g/L, a sufficient concentration to serve as electron donor for both respiratory metabolisms. The results of studies on microbial processes shows a correlation between the inhibition of denitrification and the appearance, and increase, of sulfate reduction. It is concluded that petroleum has an inhibitory effect on denitrification in marine sediments. The presence of hydrocarbons in the sediments causes a decrease in the redox potential and a concomitant stimulation of the sulfate reduction. (Agostine-PTT)

W91-06949

REPORT OF FLUOROSIS IN THE UNITED STATES SECONDARY TO DRINKING WELL WATER.

Veterans Administration Wadsworth Medical Center, Los Angeles, CA.
A. J. Felsenfeld, and M. A. Roberts.

JAMA: Journal of the American Medical Association JAMAAP, Vol. 265, No. 4, p 486-488, January 23, 1991. 1 fig, 2 tab, 17 ref.

Descriptors: *Drinking water, *Fluorides, *Fluorosis, *Halides, *Public health, *United States, *Wells, Groundwater chemistry, Water quality monitoring, Water quality standards.

In the United States, the municipal water supplies are required by federal and state regulations to be monitored at regular intervals. Standards have been established for maximum allowable levels of natural constituents. Water obtained from private wells is not subject to these regulations and, as a result, the fluoride concentration in the water is not routinely measured. In some areas of Arizona, Colorado, Illinois, Iowa, New Mexico, Ohio, Oklahoma and Texas, high fluoride concentrations in the groundwater occurs naturally. These values often exceed the recommended levels of 11 to 58 micromole/L for the prevention of dental caries. A 54-year-old female resident of Wellston, Okla., was found to have osteosclerosis on a routine chest roentgenogram. Subsequent investigation disclosed the cause of her osteosclerosis to be fluorosis secondary to the ingestion of well water containing high levels of fluoride. The fluoride concentration of the patient's well water, as measured by the Oklahoma State Dept. of Health, was 429 micromole/L. Water samples were also obtained from the 12 wells on properties adjacent to the index case. All the wells were cased with steel or plastic pipe, and each appeared to be adequately protected from surface water intrusion. In three other wells, all at similar depths as the well of the index case, the fluoride concentration of the water was greater than 212 micromole/L. Urine samples from members of the four households contained elevated urinary fluoride levels. Thus, fluorosis may develop in certain areas of the U.S. as a result of the natural occurrence of fluoride in the groundwater. Consequently, in known endemic areas, it would appear reasonable to measure fluoride concentration of the well water at the time of drilling. (Agostine-PTT)
W91-06958

EARTHWORM AND SOIL MICROARTHROPOD RESPONSES TO OILY WASTE APPLICATION.

Niagara Mohawk Power Corp., Syracuse, NY.
E. F. Neuhauser, R. A. Norton, R. C. Loehr, and D. Y. Sillman.

Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 2, p 275-281, 1989. 4 fig, 3 tab, 13 ref.

Descriptors: *Oil, *Oil pollution, *Oligochaetes, *Pollution effects, *Soil contamination, *Soil organisms, *Waste disposal, Arthropods, Biomass, Degradation, Fate of pollutants, Industrial wastes, Waste utilization.

The land treatment method of disposal, i.e. the incorporation of waste into surface soils, is designed to allow waste degradation by chemical or biological means. The land treatment of an industrial oily waste was investigated to determine the effect of its application on earthworm and soil microarthropod populations. Oily waste was applied and rototilled into field plots at seven application rates that ranged from 0.17 to 9.5 kg/sq meter total oil and grease, or from 0.09 to 5.25% oil and grease in the zone of incorporation. Control plots consisted of those with no waste application or rototilling, and those with rototilling only. Microarthropod population density followed over 2 years, showed an immediate negative effect with rototilling; clear negative effects of oily waste application occurred regardless of application rate. In all cases, recovery from rototilling was faster than recovery from waste application. It was recovery time, rather than initial effects, which varied with application rate; heavier applications required longer periods of recovery. Earthworms were able to recover much faster from rototilling than from the oily waste applications. Earthworm biomass had not completely recovered from the highest waste application rate 3 yr after application. (Author's abstract)
W91-06962

RHIZOSPHERE PH AND ALUMINUM CHEMISTRY OF RED OAK AND HONEYLOCUST SEEDLINGS.

Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
T. Ohno.

Soil Biology & Biochemistry SBIOAH, Vol. 21, No. 5, p 657-660, 1989. 2 fig, 4 tab, 21 ref.

Descriptors: *Acid rain, *Acid rain effects, *Aluminum, *Hydrogen ion concentration, *Rhizosphere, *Seedlings, *Soil chemistry, *Soil-water-plant relationships, *Trees, Chemical properties, Deciduous trees, Root zone, Toxicity.

Toxicity from aluminum solubilized by an increase in soil acidity is a possible factor linking acid deposition to forest decline. Plants are known to alter the pH of soil surrounding their roots independent of acid deposition sources. The rhizosphere soil from red oak (Quercus rubra L.) and honeylocust (Gleditsia triacanthos L.) was characterized with respect to soil pH and aluminum chemistry. The rhizosphere soil was obtained using two methods: (1) using the thin soil layer plate method; and (2) removing the soil adhering to roots from plants grown in traditional pots. In the thin soil layer study, the pH of the control soil was 5.12 while rhizosphere pH decreased to 4.85 for red oak and 5.01 for honeylocust. The decrease in pH led to increases in 1 M KCl extractable aluminum and water soluble aluminum in the rhizosphere soils. Due to the limited volume of rhizosphere soil recovered from the pot method, only soil pH was measured. The pH values were 5.02, 5.20 and 5.03 for red oak, honeylocust and control soils, respectively. These results imply that rhizosphere soils obtained by different methods will differ greatly in chemical properties. Moreover, red oak and honeylocust seedlings may alter the pH of the rhizosphere soil. Plant-soil interactions which alter pH and Al status of the rhizosphere need to be considered when assessing the role of acid deposition induced aluminum toxicity as a cause of forest decline. (Author's abstract)
W91-06964

TOXICOKINETICS AND TOXICITY OF A MIXTURE OF SEDIMENT-ASSOCIATED POLYCYCLIC AROMATIC HYDROCARBONS TO THE AMPHIPOD DIPOREIA SP.

National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
P. F. Landrum, B. J. Eadie, and W. R. Faust.

Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 35-46, 1991. 2 fig, 6 tab, 32 ref.

Descriptors: *Amphipods, *Bioaccumulation, *Bioavailability, *Marine sediments, *Polycyclic aromatic hydrocarbons, *Toxicity, *Toxicology, *Water pollution effects, Adsorption kinetics, Path of pollutants, Radioactive tracers.

Amphipods, Diporeia sp., were exposed to a reference sediment dosed with two radio-labeled polycyclic aromatic hydrocarbons (PAHs) and sediments dosed with a mixture of PAHs at four concentrations: 21.4, 41.0, 119.6, and 327.0 nmol/gm dry sediment, as the molar sum of the PAH congeners. Diporeia sp. were sampled for mortality and toxicokinetics for up to 26 days. Significant sediment avoidance was observed at the highest dose, 327 nmol/gm dry sediment as the molar sum of the PAHs. The measured organism concentration required to produce the mortality at day 19 was 2.9 micromol/gm as the sum of the bioaccumulated PAHs. The uptake clearance (gm dry sediment/gm organism/hr) from sediments for the radiotracers increased with dose to an apparent plateau. Uptake clearance is the conditional constant relating the contaminant flux into the organism to the contaminant concentration in the referenced environmental compartment, in this case the sediment. This enhanced bioavailability with dose occurred even in the absence of overt effects and in the absence of changes in the measured partition coefficients for phenanthrene effects and in the absence of changes in the measured partition coefficients for phenanthrene (273 + or -98) and pyrene (540 + or -212), between the freely dissolved radiotracers in interstitial water and the sediment particles. These changes in bioavailability with changes in PAH concentration suggest that predictions of bioaccumulation of PAH congeners from sediments under different field concentration conditions will not be possible with standard partitioning relationships. (Author's abstract)
W91-06993

VALIDATION OF A FOUR-DAY CERIODAPHNIA TOXICITY TEST AND STATISTICAL CONSIDERATIONS IN DATA ANALYSIS.

Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.

For primary bibliographic entry see Field 5A.
W91-06994

MITOCHONDRIAL RESPONSE TO CHLOROPHENOLS AS A SHORT-TERM TOXICITY ASSAY.

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
R. D. Shannon, G. D. Boardman, A. M. Dietrich, and D. R. Bevan.

Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 57-66, 1991. 2 fig, 6 tab, 34 ref.

Descriptors: *Bioassay, *Bioindicators, *Chlorinated aromatic compounds, *Mitochondria, *Phenols, *Toxicity, *Toxicology, In vitro tests, Pentachlorophenol, Respiration, Water pollution effects.

The effects of chlorophenols, common water pollutants from industrial wastes and pesticides, on rat liver mitochondrial respiratory parameters were determined and compared to the toxicities of chlorophenols in a variety of biological systems currently being used for toxicity testing. Rat mitochondrial fractions were exposed to six concentrations of five different chlorophenols in a semi-closed, 2-ml reaction vessel. Respiratory parameters were measured polarographically with an oxygen electrode and compared to control experiments. The toxicity of the chlorophenols, as measured by the concentration reducing the respiratory control ratio of the control to 50% (RCR50), increased with increasing chloro-substitution. RCR50 concentrations ranged from 599 microM with 2-chlorophenol to 0.110 microM with pentachlorophenol. The RCR50 concentrations for the five chlorophenols were compared to six physicochemical parameters for the same chlorophenols; high degrees of correlation between the RCR50 concentrations and the physicochemical parameters were found ($r >$ or $=$ 0.890). The highest correlation coefficient obtained was with the n-octanol/water partition coefficient ($r = 0.991$), indicating that the ability of chlorophenols to partition into the lipid mitochondrial membrane plays a significant role in eliciting its toxic effect. RCR50 concentrations were also compared to nine currently existing short-term toxicity tests. High degrees of correlation were obtained with several of the tests, including algal, bacterial, and fish bioassays. (Author's abstract)
W91-06995

EFFORT-ALLOCATION ANALYSIS OF THE SEVEN-DAY FATHEAD MINNOW (PIMEPHALES PROMELAS) AND CERIODAPHNIA DUBIA TOXICITY TESTS.

Oak Ridge National Lab., TN. Environmental Sciences Div.

For primary bibliographic entry see Field 5A.
W91-06996

ACUTE AVOIDANCE REACTIONS AND BEHAVIORAL RESPONSES OF JUVENILE RAINBOW TROUT (ONCORHYNCHUS MYKISS) TO GARLON 4, GARLON 3A AND VISION HERBICIDES.

E.V.S. Consultants Ltd., North Vancouver (British Columbia).
J. D. Morgan, G. A. Vigers, A. P. Farrell, D. M. Janz, and J. F. Manville.

Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 73-79, 1991. 2 tab, 22 ref. Canada/British Columbia Forest Resource Development Agreement FRDA 2.46.

Descriptors: *Avoidance, *Bioassay, *Fish behavior, *Garlon, *Herbicides, *Toxicology, *Trout, *Vision herbicide, *Water pollution effects, Juvenile growth stage, Surfactants, Toxicity.

Laboratory bioassay experiments were conducted with juvenile rainbow trout (Oncorhynchus mykiss) to determine the acute lethal (96-hr LC50) values of the forest-use herbicides Garlon 3A (triethylamine salt of triclopyr), Garlon 4 (butoxyethyl ester of triclopyr), and Vision (isopropylamine salt of glyphosate) with 15% and 10% surfactant formulations, and the threshold concentrations of these herbicides that would cause behavioral effects. A Y-maze apparatus was used to determine the threshold concentration of each herbicide that elicited either an avoidance or a preference reaction from rainbow trout fry after a 1-hr exposure period. Rainbow trout fry were observed for qualitative behavioral changes (e.g., increased coughing and ventilatory rates, loss of equilibrium, etc.) over a four-day period of exposure to a wide range of chemical strengths. Nominal concentrations of the herbicides eliciting threshold avoidance reactions in test fish were 150 ppm Vision-10% surfactant, 54 ppm Vision-15% surfactant, 19.2 ppm Garlon 4, and 800 ppm Garlon 3A, which were, respectively, 2, 2, 8, and 2 times the 96-hr LC50 values determined for each herbicide. Preferential reactions to the herbicide solutions were not observed. Qualitative behavioral changes were observed in rainbow trout fry at levels from 25% (Garlon 4) to 50% (Garlon 3A, Vision-10% and-15% surfactants) of the 96-hr LC50 values. Nominal concentrations of the herbicides causing threshold changes in fish behavior were 37.5 ppm Vision-10% surfactant, 13.5 ppm Vision-15% surfactant, 0.60 ppm Garlon 4, and 200 ppm Garlon 3A. (See also W91-06998) (Author's abstract)
W91-06997

ACUTE PHYSIOLOGICAL STRESS RESPONSES OF JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH) TO SUBLETHAL CONCENTRATIONS OF GARLON 4, GARLON 3A, AND VISION HERBICIDES.

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
D. M. Janz, A. P. Farrell, J. D. Morgan, and G. A. Vigers.

Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 81-90, 1991. 5 fig, 2 tab, 47 ref. British Columbia Ministry of Forests and Lands, FRDA 2.46.

Descriptors: *Fish physiology, *Garlon, *Herbicides, *Salmon, *Sublethal effects, *Toxicology, *Vision herbicide, *Water pollution effects, Juvenile growth stage, Respiration, Stress, Toxicity.

Juvenile coho salmon (Oncorhynchus kisutch) were exposed for 4 hr to sublethal concentrations of the herbicides Garlon 4 (butoxyethyl ester of triclopyr), Garlon 3A (triethylamine salt of triclopyr), and Vision (isopropylamine salt of glyphosate). Trials were performed in a closed-system respirometer that measured oxygen consumption of fish prior to and during a 4-hr exposure. At the end of the exposure period, plasma glucose and lactate concentrations, hematocrit, and leucocrit were measured as indicators of acute physiological stress. There were no biologically significant indications of acute physiological stress in fish exposed to Garlon 4, Garlon 3A, or Vision at 5 to 80% of the 96-hr LC50 concentrations. The results suggest that threshold herbicide concentrations causing physiological stress in short-term exposure (4 hr) in juvenile coho salmon may be higher than the 96-hr LC50 value for those herbicides. It was concluded that sublethal concentrations of Garlon and Vision herbicides do not induce significant physiological stress responses in juvenile coho salmon during a 4-hr exposure period. (See also W91-06997) (Author's abstract)
W91-06998

EFFECTS OF DISSOLVED ORGANIC CARBON ON ACCUMULATION AND ACUTE TOXICITY OF FENVALERATE, DELTAMETHRIN AND CYHALOTHRIN TO DAPHNIA MAGNA (STRAUS).

National Water Research Inst., Burlington (Ontario). Rivers Research Branch.
K. E. Day.

Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 91-101, 1991. 4 fig, 4 tab, 30 ref.

Descriptors: *Acute toxicity, *Bioaccumulation, *Daphnia, *Dissolved organic carbon, *Path of pollutants, *Pyrethrins, *Toxicity, *Toxicology, *Water pollution effects, Cyhalothrin, Deltamethrin, Fenvalerate, Insecticides.

The effects of dissolved organic carbon (DOC) in the form of Aldrich humic acid on the accumulation and acute toxicities of three synthetic pyrethroids (fenvalerate, deltamethrin, and cyhalothrin) to Daphnia magna in laboratory experiments were investigated. Concentrations of DOC as low as 2.6 mg/L, 3.2 mg/L, and 3.1 mg/L for deltamethrin, fenvalerate, and cyhalothrin, respectively, resulted in a significant decrease in bioaccumulation. Acute toxicities of all three pyrethroids were found to decrease as DOC concentrations increased; e.g., at a DOC concentration of 15.5 mg/L, the acute toxicity of fenvalerate was reduced by a factor of 17. The percentages of deltamethrin and fenvalerate bound to DOC increased as DOC concentrations increased after 2-hr and 24-hr contact times. At low concentrations of DOC (e.g. 1.7 mg/L), as much as 40% of fenvalerate and 20% of deltamethrin were found sorbed to the dissolved material. After 24-hr contact times, 76.4 and 80.8% of fenvalerate and deltamethrin, respectively, were bound to DOC. Reverse-phase partition coefficients (Krp) for both fenvalerate and deltamethrin were found to vary with DOC concentrations and were in the range 100,000 to 480,000 L/kg for fenvalerate and 90,000 to 560,000 L/kg for deltamethrin. (Author's abstract)
W91-06999

TOXICITY TO AQUATIC ORGANISMS OF OFF-TARGET DEPOSITION OF ENDOSULFAN APPLIED BY AIRCRAFT.

Environmental Protection Service, Dartmouth (Nova Scotia).
W. R. Ernst, P. Jonah, K. Doe, G. Julien, and P. Hennigar.

Environmental Toxicology and Chemistry ETOCDK, Vol. 10, No. 1, p 103-114, 1991. 4 fig, 6 tab, 21 ref.

Descriptors: *Aquatic life, *Endosulfan, *Insecticides, *Path of pollutants, *Toxicity, *Water pollution effects, Air pollution, Aircraft, Aquatic insects, Bioassay, Daphnia, Midges, Mollusks.

Aerial drift from pesticide spray applications can result in contamination of nontarget environments such as aquatic systems. The off-target deposit of aerially applied endosulfan was collected on flat plate samplers and in containers of water placed at various distances downwind of the treated area. The water contaminated by that deposit was subsequently used to conduct 24-hr lethal bioassays in a nearby temporary laboratory, using threespine stickleback (Gasterosteus aculeatus), water boatmen (Sigara alternata), caddisfly larvae (Limnephilus spp.), bivalve mollusks (Pisidium spp.), bloodworms (Chironomiidae spp.), and water fleas (Daphnia magna). Three different spray events were sampled, all of which occurred at times when meteorological conditions were within regulatory constraints. Chemical analysis of deposit collectors and exposed water indicated that deposit decreased in an exponential manner with distance downwind and ranged from 82 mg/cu m and 1.7 mg/L for plates and waters within the target site to 0.051 mg/cu m and 0.004 mg/L for plates and waters at 200 m downwind. After 24-hr exposure to spray-drift contaminated water, no mortalities that could be attributed to the pesticide were observed for bivalve mollusks, bloodworms, or water fleas, even within the treated area. Water boatmen, caddisfly larvae, and threespine stickleback, on the other hand, suffered levels of mortality that varied directly with distance downwind from the treated area. The distances at which 50% mortality was measured in water boatmen and caddisfly larvae tests were 50 m and 10 m, respectively. Threespine stickleback were the most sensitive species tested, having a mortality of up to 90% at a distance of 200 m downwind. These results demonstrate the extreme risk to aquatic organisms from drift deposit of aerially applied endosulfan and indicate the need for similar assessments of other popular pesticides. (Author's abstract)
W91-07000

USE OF RESPIRATORY-CARDIOVASCULAR RESPONSES OF RAINBOW TROUT (ONCORHYNCHUS MYKISS) IN IDENTIFYING ACUTE TOXICITY SYNDROMES IN FISH: PART 4. CENTRAL NERVOUS SYSTEM SEIZURE AGENTS.

Environmental Research Lab.-Duluth, MN.

For primary bibliographic entry see Field 5A.
W91-07001

EFFECTS OF DELTAMETHRIN ON PROTEIN PHOSPHORYLATION AND DEPHOSPHORYLATION PROCESS IN THE NERVE FIBERS OF THE AMERICAN LOBSTER, HOMERUS AMERICANUS L.

Michigan State Univ., East Lansing. Pesticide Research Center.
M. Miyazawa, and F. Matsumura.

Pesticide Biochemistry and Physiology PCBPBS, Vol. 36, No. 2, p 147-155, February 1990. 6 fig, 2 tab, 21 ref. National Institute of Environmental Health Sciences Grant RO1-ESO1963.

Descriptors: *Animal metabolism, *Deltamethrin, *Insecticides, *Lobsters, *Pyrethrins, *Toxicology, *Water pollution effects, Animal physiology, Nervous system, Proteins.

Deltamethrin, a powerful synthetic pyrethroid, was found to affect protein phosphorylation and dephosphorylation processes both in intact and in axolemma preparations from the lobster leg nerves. In intact nerve preparation the most significant result was inhibition of endogenous protein phosphorylation, particularly that on the 70-kDa protein. The overall effect of deltamethrin, tested at .0000001 M, was very similar to that caused by lowering the external Ca(2+) concentration with regard to inhibition of phosphorylation. Such an effect of deltamethrin was abolished when the concentration of the external Ca(2+) was raised from 50 to 100 mM. The effect of deltamethrin was also similar to that observed in preparations treated with .0001 M veratridine. In a cell-free in vitro system using axolemma preparation, deltamethrin at .00001 to .1 microM was found to inhibit calcium calmodulin-dependent protein kinase(s). All these results indicate that deltamethrin has the property to affect protein phosphorylation and dephosphorylation activities in the lobster nervous system. One of the proteins of which the rate of phosphorylation was affected by deltamethrin was the 260-kDa protein, likely representing the alpha-subunit of the sodium channel. (Author's abstract)
W91-07003

SUBLETHAL EFFECTS OF AN ORGANOPHOSPHORUS INSECTICIDE ON CERTAIN METABOLITE LEVELS IN A FRESHWATER FISH, PUNTIUS CONCHONIUS HAMILTON.

Kumaun Univ., Naini Tal (India). Dept. of Zoology.
T. S. Gill, J. Pande, and H. Tewari.

Pesticide Biochemistry and Physiology PCBPBS, Vol. 36, No. 3, p 290-299, March 1990. 7 fig, 1 tab, 32 ref.

Descriptors: *Animal metabolism, *Fish, *Insecticides, *Organophosphorus pesticides, *Sublethal effects, *Toxicology, *Water pollution effects, Chronic toxicity, Fish physiology, Lipids, Metabolism, Proteins.

Alterations in the metabolite levels were monitored in a common freshwater bony fish, the rosy barb (Puntius conchonius), chronically exposed to a sublethal concentration (109.5 ppm) of an organophosphorus insecticide, phosphamidon. Significant hyperglycemia, hyperlactemia, hypercholesterolemia, hyperlipemia, hyperproteinemia, and increased blood-free fatty acids were manifested in the exposed fish for up to 4 weeks. The phosphorus levels in the blood, however, fell. In other tissues, there was an increase in the hepatosomatic index, moderate hepatic and skeletal muscle glycogenesis, a severe depletion of glycogen reserves in the brain, and a significant increase in heart glycogen. Cholesterol (liver, ovary, and testes), total lipids (liver and ovary), free fatty acids (liver and skeletal muscles), and total proteins (liver) were elevated in the exposed fish, and there were signs of lipolysis and protein breakdown in the skeletal muscles. Except for the liver-free fatty acids and heart glycogen, organophosphorus effects on other variables were not abolished during recovery in clean water. (Author's abstract)
W91-07004

QUANTITATIVE STRUCTURE-ACTIVITY STUDIES OF PYRETHROIDS: 21. SUBSTITUTED BENZYL ESTERS OF 'KADETHRIC' ACID AND DEPOLARIZATION OF THE AXONAL MEMBRANE OF CRAYFISH.
Kinki Univ., Higashiosaka (Japan). Dept. of Agricultural Chemistry.
K. Matsuda, M. Hamada, K. Nishimura, and T. Fujita.
Pesticide Biochemistry and Physiology PCBPBS, Vol. 37, No. 2, p 200-209, June 1990. 7 fig, 1 tab, 17 ref.

Descriptors: *Crayfish, *Insecticides, *Pyrethroids, *Structure-activity relationships, *Toxicology, *Water pollution effects, Animal physiology, Cell membranes, Kadethrin, Nervous system, Toxicity.

The effects of a set of kadethrin analogs in which the alcohol moiety was replaced by various meta-substituted benzyl groups on the resting membrane potential in crayfish giant axons were measured with an intracellular recording technique. These compounds depolarized the membrane to various extents. Variations in the rate of depolarization, estimated from the time required to reach half the maximum depolarization, were related parabolically to the hydrophobicity of the compounds. Depolarization within 30 min after the start of treatment with each compound was mostly related to an increase in the axonal membrane permeability for sodium ions. With prolonged treatment, other factors, such as the loss the ion selectivity of channels (perhaps caused by damage of the membrane structure), became progressively more important with time. Two kinds of depolarizing potency parameters, one mainly due to the change in permeability to sodium ions and the other including other factors, were defined and estimated from membrane potentials observed under different conditions. When the effect of the hydrophobicity of the compounds on the transport process was considered separately, such whole-body symptomatic activities as lethal and convulsive activities against American cockroaches and knockdown activity against house flies were correlated well to the depolarizing potency parameters. The higher depolarizing activity correlated well with higher whole-body activities. (Author's abstract)
W91-07005

ENZYME MODULATION BY SUBLETHAL CONCENTRATIONS OF ALDICARB, PHOSPHAMIDON, AND ENDOSULFAN IN FISH TISSUES.
Thomas Jefferson Univ., Philadelphia, PA. Dept. of Anatomy.
T. S. Gill, J. Pande, and H. Tewari.
Pesticide Biochemistry and Physiology PCBPBS, Vol. 38, No. 3, p 231-244, November 1990. 6 fig, 1 tab, 34 ref.

Descriptors: *Aldicarb, *Endosulfan, *Enzymes, *Fish, *Insecticides, *Phosphomidan, *Sublethal effects, *Toxicity, *Toxicology, *Water pollution effects, Animal tissues, Carbamate pesticides, Chlorinated hydrocarbon insecticides, Fish physiology, In vitro tests, In vivo tests.

Enzyme modulation by acutely sublethal concentrations of aldicarb, phosphamidon, and endosulfan was examined in vivo and in vitro in different tissues of a fish, Puntius conchonius Hamilton. The acetylcholinesterase (AchE) activity in brain and gills was decreased by the three pesticides tested. In the skeletal muscles, while aldicarb and phosphamidon inhibited the enzyme, the endosulfan caused stimulation of AchE activity. The hepatic acid phosphatase activity (AcP) was inhibited by aldicarb and phosphamidon but stimulated by endosulfan in vivo. In the gills, kidneys, and gut, however, the AcP activity was generally enhanced in vivo and decreased in vitro. Liver, gut, and ovaries showed inhibition of alkaline phosphatase (AlP) with aldicarb and phosphamidon whereas the endosulfan induced both a reduction and a stimulation of the enzyme activity. Gills and kidneys revealed AlP stimulation with all three pesticides. The glutamate-oxaloacetate transaminase was inhibited in the liver, gills, and kidneys but the activity was raised in the heart during pesticide exposure. In the liver, kidneys, and heart, the glutamate-pyruvate transaminase (GPT) activity was both increased and decreased during varying test conditions but the pesticides generally caused stimulation of this enzyme in the gills and skeletal muscles. The lactic dehydrogenase (LDH) activity was increased by aldicarb in the gills, skeletal muscles, and heart but inhibited in the liver. Phosphamidon and endosulfan induced inhibition of LDH activity in all the tissues except for an increase seen in heart muscles in vitro. With few exceptions, the in vivo and in vitro effects of pesticides on enzymes were qualitatively similar. (Author's abstract)
W91-07006

IMPACT OF CD AND DIFFERENT PH ON THE AMPHIPOD GAMMARUS FOSSARUM KOCH (CRUSTACEA: AMPHIPODA).
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
I. B. Musko, W. Meinel, R. Krause, and M. Barlas.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 1, p 11-16, 1990. 6 fig, 2 tab, 31 ref.

Descriptors: *Acid rain effects, *Acute toxicity, *Amphipods, *Bioindicators, *Cadmium, *Hydrogen ion concentration, *Toxicology, *Water pollution effects, Crustaceans, Toxicity.

Acute toxicity tests were carried out at different pH conditions (pH 4.5, 6.0 and 8.5) on the amphipod Gammarus fossarum Koch in the presence of different concentrations of cadmium. G. fossarum shows a lower survival rate at lower pH than at a higher one in the absence of Cd. The median period of survival decreased with increasing pH in the presence of Cd. Median lethal concentrations (24, 48 and 96 hr LC50's) indicate that G. fossarum is highly sensitive to Cd at pH 8.5 (96 hr LC50 proved to be 6.2 micrograms/L). (Author's abstract)
W91-07018

ACCUMULATION AND METABOLISM OF 2,4,6-TRICHLOROPHENYL-4'-AMINOPHENYL ETHER BY CARP.
Shiga Prefectural Inst. of Public Health and Environmental Science, Otsu (Japan).
For primary bibliographic entry see Field 5B.
W91-07019

BIOCONCENTRATION AND EXCRETION OF DIAZINON, IBP, MALATHION AND FENITROTHION BY CARP.
Shiga Prefectural Inst. of Public Health and Environmental Science, Otsu (Japan).
For primary bibliographic entry see Field 5B.
W91-07020

COMPARISON OF THE ACCUMULATION, TISSUE DISTRIBUTION AND SECRETION OF CADMIUM IN DIFFERENT SPECIES OF FRESHWATER FISH.
University Coll., Cardiff (Wales). Dept. of Biochemistry.
For primary bibliographic entry see Field 5B.
W91-07021

ALUMINIUM INHIBITION OF CALCIUM CARBONATE CRYSTAL GROWTH: IN VITRO STUDIES RELATED TO SHELL-REPAIR IN THE SNAIL HELIX POMATIA L.
Uppsala Univ. (Sweden). Dept. of Zoophysiology.
M. Reineskog.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 2, p 353-356, 1990. 2 fig, 14 ref.

Descriptors: *Acid rain effects, *Acidification, *Aluminum, *Animal metabolism, *Calcium carbonate, *Inhibition, *Snails, *Water pollution effects, Calcium, Chemical precipitation, Crystallization, Hydrogen ion concentration.

Aluminum (Al) was found to have an inhibitory effect on the in vitro recalcification of demineralized shell-repair membranes from the snail Helix pomatia L. The Ca contents of the membranes were inversely proportional to the Al dose. In a pH-stat system the precipitation of CaCO3 was reduced by AlCl3 in a dose-dependent manner. The reduction was aggravated by the addition of citrate. Addition of demineralized repair membranes to this system was without effect. Al, probably by adhering to the crystals (no effects on the initial nucleation being observed), has the ability to interfere with the precipitation of CaCO3. The increased inhibition caused by Al together with citrate seems attributable to the formation of Ca-citrate complexes as almost no Al-citrate complex is formed at the pH (7.95) used in the pH-stat experiments. (See also W91-07024) (Author's abstract)
W91-07023

ALUMINIUM PHOSPHATASE ACTIVITIES AND SHELL-REPAIR. STUDIES IN THE SNAIL HELIX POMATIA L.
Uppsala Univ. (Sweden). Dept. of Zoophysiology.
M. Reineskog.
Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 96, No. 2, p 357-360, 1990. 1 fig, 1 ref, 26 ref.

Descriptors: *Acid rain effects, *Acidification, *Aluminum, *Animal metabolism, *Phosphatases, *Snails, *Water pollution effects, Calcium, Enzymes.

Aluminum, injected as AlCl3 in the snail Helix pomatia L., affected the activities of both acid and alkaline phosphatase in homogenates prepared from the mantle. In snails with intact as well as damaged shells the activity of acid phosphatase was increased by Al, while that of alkaline phsophatase was decreased. In the shell-damaged snails the activity of the acid phosphatase was approximately 15% lower and the activity of the alkaline phosphatase roughly 20% higher than that of the intact snails receiving the same Al-dose. As the changes in enzyme activity associated with shell-repair are unaffected by Al, apparently the reduced weights of the shell-repair membranes and effects on the phophatases, although both a result of the Al-injections, are independent of each other. (See also W91-07023) (Author's abstract)
W91-07024

TOLERANCE OF ACID WATERS BY NATIVE BROWN TROUT (SALMO TRUTTA L).
Saint Andrews Univ. (Scotland). Gatty Marine Lab.
J. C. Battram.
Comparative Biochemistry and Physiology (C)

CBPCEE, Vol. 96, No. 2, p 377-380, 1990. 4 fig, 27 ref.

Descriptors: *Acid rain, *Acid rain effects, *Acid tolerance, *Hydrogen ion concentration, *Trout, *Water pollution effects, Acclimatization, Animal metabolism, Chlorides, Fish hatcheries, Ion transport, Scotland.

Chloride transport by brown trout was compared between hatchery reared fish from a relatively neutral pH area, and others from Galloway in southwest Scotland where the water is low in calcium and relatively acidic. The fish were given an acid challenge in their own and each others 'native' medium to examine the effect on chloride transport. The hatchery fish are clearly very much less able to maintain chloride influx and efflux rates when challenged with low pH than the Galloway fish. Both strains of Salmo trutta show the ability to recover chloride influx after a 2 hr episode of low pH. Acclimation to low pH conditions probably occurs, but only over several generations of fish. (Hoskin-PTT)
W91-07025

5D. Waste Treatment Processes

DISINFECTION OF SEWAGE, STORMWATER AND FINAL EFFLUENT.
Acer Environmental, Stevenage (England).
V. K. Thomas, G. J. Realey, and D. W. Harrington.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 422-429, October 1990. 3 fig, 6 tab, 16 ref.

Descriptors: *Disinfection, *Effluents, *Storm water, *Wastewater treatment, Chemical properties, Chlorination, England, Ozone, Ultraviolet radiation.

The Water Research Center has conducted a review of potential processes for sewage, stormwater and effluent disinfection for the purpose of identifying disinfectants which could be used to achieve compliance with the European Community Directive for bathing waters. The disinfection of crude sewages and stormwater discharges presents problems related to the greater chemical disinfectant demand exerted by stronger wastewaters, together with their higher solids content, compared to sewage effluents. Established or promising techniques include: (1) for crude sewage; peracetic acid dosing and pH adjustment; (2) for stormwater; peracetic acid dosing; and (3) for effluent; ozonation, UV radiation and peracetic acid dosing. All techniques may result in side-reactions and the possible formation of by-products. The current capital expenditure required to build conventional sea outfalls to obtain full compliance is likely to be considerable. Disinfection may be a short-term palliative or a long-term solution at some sites, particularly for estuarine or inland discharges. (Author's abstract)
W91-05968

OPTIONS AVAILABLE FOR AMMONIA REMOVAL AT DAVYHULME SEWAGE-TREATMENT WORKS.
Davyhulme STW, North West Water, England.
J. F. Dolan, M. J. O'Neill, and N. J. Horan.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 457-468, October 1990. 4 fig, 5 tab, 14 ref.

Descriptors: *Activated sludge, *Ammonia, *Ammonia removal, *Biological filters, *Ion exchange, *Nitrification, *Wastewater treatment, Dissolved oxygen, England, Estuaries.

Davyhulme sewage-treatment works, which serves the Manchester, drainage area, is one of the largest in England. The dry-weather flow is 300,000 cu m/d and the plant receives a wide range of industrial effluents. The plant has been identified as a major source of pollution in the Mersey estuary, with an average discharge of 6500 kg ammonia/day. As part of its initiative to improve the Mersey estuary, North West Water Works intends to reduce the daily ammonia load from Davyhulme to about 1000 kg/d by 1995. On-site pilot plants were established in order to assess the capabilities of both conventional and novel processes to achieve this degree of ammonia removal. To date, the studies have shown that nitrification can be achieved by both single-stage activated-sludge and nitrifying filters. However, the activated-sludge option full-scale trials have not produced the required effluent quality. The small-scale filter units cannot accurately replicate the operating capabilities of a full-scale plant or simulate environmental impact. For both processes, questions remain unanswered as to the long-term guarantee of performance in meeting the target standards. (Author's abstract)
W91-05973

CHADWICK CENTENARY LECTURE--A REVIEW OF TWO CENTURIES OF PUBLIC HEALTH.
World Health Organization, Geneva (Switzterland). Community Water Supply and Sanitation Unit.
For primary bibliographic entry see Field 5G.
W91-05975

SANITATION IN RURAL COMMUNITIES IN BANGLADESH.
Upazilla Health Complex, Chouddogram, Comilla, Bangladesh.
M. Yusuf, and A. M. Z. Hussain.
Bulletin of the World Health Organization BWHOA6, Vol. 68, No. 5, p 619-624, 1990. 3 tab, 3 ref, append.

Descriptors: *Bangladesh, *Developing countries, *Drinking water, *Human diseases, *Public health, *Rural areas, *Sanitation, *Waste disposal, *Water pollution sources, Domestic wastes, Economic aspects, Parasites, Social aspects, Water supply, Water use.

Domestic sanitation, an important determinant of health or disease in human populations has been neglected in developing countries. In Bangladesh, one of the least developed countries in the world, communicable diseases and parasitic infestations are widespread and improvements in sanitation are possible only if adequate information is available, on the basis of which planning and evaluations may be undertaken. Data presented were collected on sanitary conditions in the rural areas of Bangladesh where 85% of the population live, in 1980-1990. It was observed that even where a safe water supply and sanitary latrines were provided, people did not always use them. While 23% of the studied households had sanitary latrines, children in about 11.5% of these households did not use them and women in about 6% of households did not use them for micturition at night. Not a single house in the study area could fulfil all the criteria of sanitary housing in a strict sense; for example, although 34.5% of the households had tubewells, only 11.5% of them had a satisfactory level of water usage. Since socioeconomic conditions and education influence the level of sanitation, improvements in both are required. (Medina-PTT)
W91-05992

ISOLATION OF SOME NEW SULPHUR BACTERIA FROM ACTIVATED SLUDGE.
Isfahan Univ. (Iran). Dept. of Biology.
G. Emtiazi, M. H. Habibi, and M. Setareh.
Journal of Applied Bacteriology JABAA4, Vol. 69, No. 6, p 864-870, December 1990. 6 fig, 2 tab, 19 ref.

Descriptors: *Activated sludge, *Bacterial physiology, *Bulking sludge, *Culture media, *Sulfur bacteria, *Wastewater treatment, Aerobic bacteria, Anaerobic bacteria, Corrosion, Fertility, Nitrogen cycle, Soil bacteria.

While studies were being conducted on the bulking of activated sludge, new sulfur microorganisms which were able to grow aerobically and anaerobically on reduced sulfur compounds were isolated from the aeration tank of a wastewater-treatment plant and cultured on thiosulfate agar. They were named (1) Thiosphaera persica (motile, Gram-negative, and cocci shaped); (2) Thiobacillus persica (motile, Gram-negative, and rod shaped); and (3) Sulphobacter polymorpha (motile, Gram-negative, oxidase-negative, catalase-positive, and both rod and cocci shaped). An interesting feature of these strains is their good growth in a medium described for Nitrosococcus and Nitrobacter which contains no organic matter, hydrogen, or thiosulfate. It is not known whether these new strains use ammonium chloride as a source of energy. Thiobacillus persica can produce nitrite from ammonium chloride heterotrophically; hence, it may use this compound as an energy source. Since they are both anaerobic and aerobic, and sulfur-oxidizing, these bacteria could have significant roles in the nitrogen cycle, the induction of corrosion, soil fertility, as well as having potential use in wastewater treatment. (Medina-PTT)
W91-06004

RECENT DEVELOPMENTS IN WASTEWATER MANAGEMENT IN JAPAN.
Japan Sewage Works Association, Tokyo.
For primary bibliographic entry see Field 5G.
W91-06041

CURRENT SITUATION AND PROBLEMS OF JAPANESE INTERNATIONAL COOPERATION IN THE FIELD OF WATER SUPPLY AND WASTE MANAGEMENT.
Ministry of Health and Welfare, Tokyo (Japan). Water Supply and Environmental Sanitation Dept.
For primary bibliographic entry see Field 6E.
W91-06062

BACTERIA AND VIRUS REMOVAL FROM SECONDARY EFFLUENT IN SAND AND RED MUD COLUMNS.
Murdoch Univ. (Western Australia). School of Biological and Environmental Sciences.
G. E. Ho, R. A. Gibbs, and K. Mathew.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 261-270, 1991. 5 fig, 3 tab, 14 ref.

Descriptors: *Bacteria, *Escherichia coli, *Land disposal, *Salmonella, *Sand filters, *Viruses, *Wastewater disposal, *Wastewater treatment, Bauxite, Groundwater recharge, Pathogens, Soil columns.

Not all soils are adequate for land disposal of wastewater. Sands with a high infiltration rate, such as those in areas of Perth, Western Australia, may fail to remove pollutants at reasonable application rates. Column experiments were conducted to determine the improvement in the removal of Escherichia coli, Salmonella adelaide, and poliovirus-1 through sands by amendment with bauxite refining residue. The residue (red mud) was neutralized using 5% gypsum and incorporated to form 30% of the amended sands. In 65 cm long soil columns the removal of the three organisms in the amended sand columns was excellent with over seven orders of magnitude reduction in concentration. Removal in unamended sands was poor. From breakthrough curves in unamended sand columns filtration, die-off and adsorption all appear to play a role in organism removal. The results also show that E. coli can be used as an indicator for contamination, though S. adelaide was less efficiently removed than E. coli. Poliovirus was more efficiently removed than E. coli. (Author's abstract)
W91-06068

ADVANCEMENTS IN TOXICITY TESTING APPLIED TO DESIGN AND CONTROL OF BIOLOGICAL PROCESSES.
Illinois Univ., Urbana. Dept. of Civil Engineering.
E. E. Herricks, B. E. Rittmann, C. P. L. Grady, D. Pascoe, and L. Somlyody.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 271-282, 1991. 3 fig, 2 tab, 31 ref.

Descriptors: *Bioassay, *Bioindicators, *Biological treatment, *Biotechnology, *Process control, *Sanitary engineering, *Testing procedures, *Tox-

icity, *Wastewater facilities, *Wastewater treatment, Environmental protection, Monitoring, Risk assessment, Warning systems, Water treatment.

The design of water and wastewater treatment processes often depends on the selection and analysis of parameters which, when measured, provide an indication of the effectiveness and efficiency of the process. Toxicity testing is an essential tool for assessing the effects and fate of many low-concentration toxicants in wastewater treatment systems. Toxicity testing can be divided into two parts: diagnostic toxicology evaluates the toxicity of a contaminant, effluent, or process, and toxicological engineering bases engineering design on the removal or production of toxicity. Six recent advancements in diagnostic toxicology and toxicological engineering have been identified by members of the Specialty Group on Hazard Assessment and Control of Environmental Contaminants. They are (1) an ecological framework for applying toxicity testing, (2) biological early warning systems for on-line detection of toxic inputs, (3) in-plant testing to detect and mitigate a toxic upset, (4) methods for rapid and cost-effective detection of genotoxins, (5) an approach for determining what discharged component must be controlled to eliminate an ecosystem disturbance, and (6) an application of process kinetics to design biological processes that are resistant to toxic upsets. Online monitoring systems using living systems, particularly biological early warning systems, are becoming more common. (Tappert-PTT)
W91-06069

SELECTION OF BACTERIAL AND FUNGAL STRAINS FOR BIOACCUMULATION OF HEAVY METALS FROM AQUEOUS SOLUTIONS.
Council for Scientific and Industrial Research, Pretoria (South Africa). Div. of Water Technology.
A. U. Wnorowski.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 309-318, 1991. 3 fig, 7 tab, 32 ref.

Descriptors: *Aquatic bacteria, *Aquatic fungi, *Bioaccumulation, *Heavy metals, *Industrial wastewater, *Wastewater treatment, Cadmium, Gold, Nickel, Silver, South Africa, Water treatment.

The ability of microorganisms to accumulate heavy metals is a well-known phenomenon, and is regarded as a powerful tool against heavy metal toxicity. Eighty strains of fungi and heterotrophic bacteria, isolated from natural water sources in South Africa polluted with heavy metals, were tested for their bioaccumulation abilities. Metal-resistant strains were first selected in a preliminary step, using nutrient agar supplemented with relevant metal salts. Preselected cultures were then screened for gold, silver, nickel and cadmium uptake capabilities. A collection of bioaccumulating strains, consisting of 39 strains for the recovery of gold, 9 strains for silver, 28 for cadmium, and 22 for nickel has been established. All the strains selected were able to remove metals tested from diluted solutions (ca. 5 mg/L) to levels below 0.5 mg/L. The maximum uptake capacity of strains was determined in concentrated metal solutions (20-50 mg/L). Nine of the strains had saturation values of 100 mg/g dry weight or higher. Optimal pH for metal uptake varied with the element, ranging from 2.5 for silver to 11.0 for cadmium. For more concentrated solutions of cadmium the highest pH obtainable without precipitation was 8.5, which was too low to achieve maximum uptake. (Author's abstract)
W91-06073

PRESENT SITUATION AND PROBLEMS RELATED TO MARINE OILY-WATER SEPARATING TECHNIQUES.
Ship Research Inst., Tokyo. Ship Equipment Div.
For primary bibliographic entry see Field 5G.
W91-06074

EVALUATION OF GENOTOXICITY USING DNA REPAIRING TEST FOR CHEMICALS PRODUCED IN CHLORINATION AND OZONATION PROCESSES.
Kyoto Univ. (Japan). Dept. of Environmental and Sanitary Engineering.
For primary bibliographic entry see Field 5B.
W91-06075

IDENTIFICATION OF NON-BIODEGRADABLE, HYDROPHILIC, ORGANIC SUBSTANCES IN INDUSTRIAL AND MUNICIPAL WASTE WATER TREATMENT PLANT-EFFLUENTS BY LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY (LC/MS/MS).
Technische Hochschule Aachen (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
H. F. Schroder.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 339-347, 1991. 17 fig, 12 ref.

Descriptors: *Analytical methods, *Gas chromatography, *Gas liquid chromatography, *Liquid chromatography, *Mass spectrometry, *Wastewater analysis, *Wastewater treatment, Chemical oxygen demand, Degradation products, Effluents, Influent streams, Metabolites, Performance evaluation.

Liquid chromatography provides advantages over gas chromatography for detecting polar non-volatile thermolabile substances in wastewater influent and effluent. Effluents of biological wastewater plants containing high concentrations of non-biodegradable substances measured as COD (chemical oxygen demand) were analyzed by gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/tandem mass spectrometry (LC/MS/MS). GC/MS could detect any relevant compound because of the nonvolatility of these substances. LC/MS/MS was able to give molecular weight information without any separation bypassing analytical column. Daughter and parent ions formed by MS/MS gave structural information by fragmentation under CID-conditions (collisionally induced dissociation) even for UV-non-detectable chromaphor missing substances. Metabolites and anthropogenic, non-biodegradable substances such as polyether, nonionic alkyl and arylsurfactants, and benzene-sulfonic acid could be detected and identified after C18 column separation and without any prior separation column. Analysis without any separation could be done within a few minutes up to an hour, and column separation lasted 10 to 100 times longer. (Tappert-PTT)
W91-06076

MICROBIAL DEGRADATION OF PENTACHLOROPHENOL AND LINDANE IN LABORATORY-SCALE ACTIVATED SLUDGE REACTORS.
Vandkvalitetsinstitutet, Hoersholm (Denmark).
B. Jacobsen, N. Nyholm, B. Pedersen, O. Poulsen, and P. Ostfeldt.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 349-356, 1991. 4 fig, 2 tab, 12 ref. Danish Technical Research Council grant 5177G12.

Descriptors: *Activated sludge process, *Lindane, *Microbial degradation, *Pentachlorophenol, *Wastewater treatment, Biodegradation, Biomass, Mixed liquor solids, Nutrient removal, Retention time, Wastewater reactors.

The microbial degradation of pentachlorophenol (PCP) and lindane in the activated sludge process was studied by performing fourteen steady-state experimental runs in single-stage activated sludge reactors, under varying operating conditions. PCP and lindane mixed with three other model compounds were added to the feed as secondary substrate, with synthetic sewage as primary substrate. Reactor concentrations (dissolved) of the model compounds were in the range of 1-200 micro/L. For PCP, the biodegradation increased with increasing solids retention time (SRT). This indicates that degradation takes place by catabolic growth of a specific fraction of the biomass. At an SRT greater than eight days the first order biodegradation rate constant was about 0.0025 L/(mg Mixed Liquor Suspended Solids (MLSS) per day) at a temperature of 15 C. For lindane, the reverse relation was observed. Increased degradation was observed with increasing degradation of primary substrate. This indicates the presence of other mechanisms such as co-metabolism or probably reductive dechlorination. In relation to upgrading of wastewater treatment plants to biological nutrient removal, xenobiotic compounds behaving like PCP are expected to be increasingly degraded. For compounds behaving like lindane, co-metabolic activity can be stimulated in plug-flow reactors, and anaerobic zones in the activated sludge process may play an important role for their degradation. (Author's abstract)
W91-06077

ACTIVATED SLUDGE PROCESS RESPONSE TO VARIABLE INPUTS OF VOLATILE ORGANIC CONTAMINANTS.
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
H. Melcer, S. G. Nutt, and H. Monteith.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 357-365, 1991. 3 fig, 5 tab, 6 ref.

Descriptors: *Activated sludge process, *Biodegradation, *Organic compounds, *Trace metals, *Volatile organic compounds, *Wastewater treatment, Chlorinated compounds, Hydraulic retention time, Organic loading, Solids retention time, Wastewater analysis, Wastewater reactors.

Municipal sewage treatment plants are generally effective in removing trace metals and organic compounds under normal operating conditions. Sampling programs at full-scale treatment facilities have shown that they are exposed to a varying range of contaminant loadings in terms of both specific compounds and their concentrations. Laboratory-scale activated sludge treatment systems were operated under dynamic loading conditions to investigate the non-steady state behavior of volatile organic compounds (VOCs) under controlled conditions. Four step tests were conducted in which an incremental increase in the concentrations of selected contaminants was applied to the reactor feed from background levels of about 15 microg/L to levels of about 100 microg/L, for a duration of approximately three hydraulic retention times. Although it was not possible to define the relative contributions of stripping and biodegradation to the removal of the test VOCs, different mechanisms are responsible for the removal of short-term, non-steady state inputs of chlorinated and non-chlorinated VOCs. No apparent effect of solids retention time (SRT) or hydraulic retention time (HRT) on VOC removal was observed at the conditions tested. (Author's abstract)
W91-06078

PEROXIDE PRE-OXIDATION OF RECALCITRANT TOXIC WASTE TO ENHANCE BIODEGRADATION.
Delaware Univ., Newark. Dept. of Civil Engineering.
J. B. Carberry, and T. M. Benzing.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 367-376, 1991. 4 fig, 10 tab, 33 ref.

Descriptors: *Biodegradation, *Hydrogen peroxide, *Industrial wastes, *Land disposal, *Pretreatment of wastes, *Waste disposal, *Waste treatment, Aquifers, Hazardous wastes, Soil contamination, Soil organisms, Waste dumps.

Land disposal is required for industrial chemicals which are not readily biodegraded. Such compounds may create adverse effects to the environment if they escape containment. Recalcitrant and persistent hydrocarbons and chlorinated chemicals are inherently resistant to any degree of biodegradation and cause a growing threat to underground aquifer quality. Hydrogen peroxide is a potentially economical method of pre-oxidation utilized to enhance the biodegradation of persistent and recalcitrant organics in contaminated soil systems. This pre-oxidation technology was examined in a laboratory respirometer using three model organic chemicals: toluene, trichloroethylene, and pentachlorophenol. Microbial cultures were selected from contaminated sites for the degradation of each model organic chemical. The rate at which the

microbes degraded the organic chemicals in unoxidized aqueous systems was compared to the rate of degradation in peroxide pre-oxidized aqueous systems. Results indicated that pre-oxidation enhanced the biodegradation of trichloroethylene and pentachlorophenol. Toluene, in contrast, was not significantly oxidized by pretreatment with hydrogen peroxide, and its biodegradation rate was not enhanced by the oxidation pre-treatment process. (Author's abstract)
W91-06079

REMOVAL OF CHLOROPHENOLS FROM WATER BY PHOTOCATALYTIC OXIDATION.
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W91-06080

SUPERCRITICAL WATER OXIDATION--WASTEWATERS AND SLUDGES.
Texas Univ. at Austin. Dept. of Civil Engineering.
A. Shanableh, and E. Gloyna.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 389-398, 1991. 8 fig, 1 tab, 12 ref.

Descriptors: *Environmental protection, *Hazardous waste disposal, *Sludge disposal, *Supercritical water oxidation, *Wastewater disposal, *Wastewater treatment, Economic aspects, Incineration, Organic compounds, Organic wastes, Toxic wastes, Water pollution control.

Two options exist for the complete destruction of toxic wastewaters and organic sludges: incineration and supercritical water oxidation (SCWO). SCWO is a low-cost alternative that avoids the capital costs and political problems of incineration. Environmental contaminants can be eliminated through the use of supercritical oxidation techniques. A comprehensive supercritical oxidation research laboratory, including bench and pilot-scale facilities has been developed. High temperature and pressure systems slightly less than and greater than supercritical water conditions can be used for the efficient destruction of waste biological treatment plant sludges, acetic acid, 2-nitro phenol, 2,4-dimethyl phenol, phenol, and 2,4-dinitro toluene. Above 400 C, near complete destruction of sludge and transformation compounds such as acetic acid can be achieved with relatively short residence times. Ammonia and acetic acid are transformation products in the SCWO of biological treatment plant sludges. Acetic acid produced from the oxidation of sludge is oxidized rapidly at supercritical temperatures, 400 C to 450 C. Contaminant destruction levels were greater than 99% using the SCWO technology. (Author's abstract)
W91-06081

BIOLOGICAL TREATMENT OF A LANDFILL LEACHATE CONTAINING PHENOXY HERBICIDES AND CHLOROPHENOLS.
Massey Univ., Palmerston North (New Zealand). Dept. of Biotechnology.
P. J. McAllister, S. M. Rao Bhamidimarri, R. Chong, and G. J. Manderson.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 413-418, 1991. 4 fig, 4 tab, 15 ref.

Descriptors: *Biodegradation, *Biological treatment, *Bioremediation, *Chlorophenols, *Landfills, *Leachates, *Phenoxy acid herbicides, *Wastewater treatment, *Water pollution treatment, Activated sludge process, Bioassay, Herbicides, Microbial degradation, New Zealand, Waste treatment.

The biological degradation of chlorinated phenols and phenoxyacetic acids has been widely reported, and the biodegradation pathways for these chemicals has been established, indicating the feasibility of biological treatment for such wastes. Chlorophenols derived from the herbicide 2,4-D was found leaching from a landfill in New Zealand. A biological treatment process has been developed for a landfill leachate containing phenoxyacetic acid herbicides and their associated chlorophenols. The mixed microbial population (Pseudomonas sp.) enriched from soil was capable of mineralizing the key phenoxy components and has been found to be stable over 700 days in continuous culture, removing 99.5% of phenoxies and 96.7% of chlorophenols. Toxicity tests using D. magna and Microtox systems have shown a 90% reduction in toxicity by biological treatment. A laboratory activated sludge system was developed resulting in complete degradation of the chlorophenols and phenoxies. (Author's abstract)
W91-06084

EFFICACY OF A JUVENILE HORMONE MIMIC, PYRIPROXYFEN (S-31183), FOR MOSQUITO CONTROL IN DAIRY WASTEWATER LAGOONS.
California Univ., Parlier. Mosquito Control Research Lab.
F. S. Mulligan, and C. H. Schaefer.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 1, p 89-92, March 1990. 2 tab, 10 ref.

Descriptors: *Animal wastes, *Insecticides, *Mosquitoes, *Wastewater lagoons, *Wastewater treatment, Adsorption, Dairy industry, Larval growth stage, Organic matter, Water pollution effects, Water quality.

Pyriproxyfen (S-31183) was applied to dairy wastewater lagoons in Fresno County, California, during 1988, at 0.1 kg active ingredient per ha in single and multiple applications which resulted in control of mosquito larvae for periods of 7 to 68 days. Length of the control period appeared to be related to water quality, with greater residual efficacy in more polluted sources. The active ingredient apparently adsorbed onto organic debris where efficacy remained high in the lagoon even after water was pumped from the lagoon and replenished with untreated wastewater. Because of the high potential for development of resistance to pyriproxyfen during prolonged exposure of a large population of mosquitoes, applications of an entirely unrelated control agent (larvicidal oil) were alternated between multiple pyriproxyfen applications. Alternating treatments with control agents having a different mode of action is suggested to avoid selection of insecticide resistance. (Author's abstract)
W91-06123

SOLIROC PROCESS IN NORTH AMERICA: A STABILIZATION/SOLIDIFICATION TECHNOLOGY FOR THE TREATMENT OF METAL-BEARING WASTES WITH REFERENCE TO EXTRACTION PROCEDURE TOXICITY TESTING.
Tricil Environmental Services, Antioch, TN.
D. Ezell, and P. Suppa.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 7-14, 1 fig, 6 tab, 1 ref, append.

Descriptors: *Hazardous waste treatment, *Heavy metals, *Toxicity, *Waste solidification, *Waste stabilization, *Waste treatment, *Wastewater treatment, Chelation, Chemical precipitation, Comparison studies, Lime, Solidification.

The Soliroc Process is a European stabilization/solidification technology which is used in the treatment of liquid wastes containing heavy metals. Laboratory-scale studies of the Soliroc Process have been carried out at 3 North American waste treatment facilities, and has also been contracted out to an independent consultant to carry out similar studies. Waste samples at each facility were treated using Soliroc technology, and then subjected to the Extraction Procedure Toxicity Test (EP Tox). In all the lab tests conducted, identical waste samples were also treated using a conventional lime precipitation process and compared with the Soliroc results. The results indicated superior performance of the Soliroc process to lime precipitation with respect to the EP Tox test. In addition, chelating agents were found not to adversely affect the EP Tox results of the Soliroc process. (See also W91-06124) (Author's abstract)
W91-06125

SOLUBILITY AND STABILITY OF INORGANIC IODIDES: CANDIDATE WASTE FORMS FOR IODINE-129.
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
For primary bibliographic entry see Field 5E.
W91-06148

HAZARDOUS AND INDUSTRIAL SOLID WASTE MINIMIZATION PRACTICES.
For primary bibliographic entry see Field 5E.
W91-06158

HAZARDOUS WASTE REDUCTION EFFORTS IN THE DEPARTMENT OF THE ARMY.
Office of the Assistant Chief of Engineers (Army), Washington, DC.
N. M. Pomerleau, J. J. McCarthy, and J. T. Bandy.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 7-16, 1 tab.

Descriptors: *Hazardous wastes, *Military reservations, *Waste disposal, *Waste management, *Waste reduction, Databases, Land disposal, Recycling, Waste treatment.

The Department of the Army generates approximately 102,000 metric tons of hazardous waste each year. Nearly 90% of these wastes are produced by the Army's industrial activities. The typical method of treatment has been land disposal. Because of the costs associated with managing these wastes, both in terms of final disposal and corrective actions, and recent legislation emphasizing waste reduction, the Army elevated the management of all wastes to the highest levels; previously, the Army had maintained a decentralized program by individual Army installations. The Army established policy goals for reducing the disposal of solvents, a significant hazardous waste contributor. In 1985, Army industrial activities developed waste reduction strategies for all other types of hazardous wastes that also emphasize front-end reduction, using methods such as materials substitution, recycling, and process changes to achieve specific process reduction goals. To further facilitate the Army's hazardous waste reduction objectives, a study is being conducted to assess all hazardous waste reporting requirements, as provided by local, state, Federal, and international regulation and Army policy. The findings and recommendations from this study will support a concurrent study to identify and develop the most appropriate type of computer database to record the necessary hazardous waste data. Two additional studies are being conducted, in concert, to refine a hazardous materials tracking system and to evaluate and rank waste reduction options economically. These studies, in support of ongoing waste reduction initiatives, and continuing waste reduction committee forums, will enhance the Army's efforts to meet its hazardous waste reduction objectives and goals. (See also W91-06158) (Lantz-PTT)
W91-06159

WASTE MINIMIZATION PROGRAM AT THE FEED MATERIALS PRODUCTION CENTER.
Westinghouse Materials Co. of Ohio, Cincinnati.
For primary bibliographic entry see Field 5E.
W91-06160

RESULTS OF FIELD SAMPLING PROGRAMS CONDUCTED AT WASTE SOLVENT TREATMENT AND RECYCLING FACILITIES.
Alliance Technologies Corp., Bedford, MA.
For primary bibliographic entry see Field 5E.
W91-06165

APPLICATION OF A MOBILE SOLVENT RECOVERY PROCESS TO MINIMIZE HAZARDOUS WASTE.
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
T. C. Keener.
IN: Hazardous and Industrial Solid Waste Minimi-

zation Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 104-112, 2 fig, 2 tab.

Descriptors: *Hazardous wastes, *Industrial wastes, *Recycling, *Solvents, *Waste recovery, *Waste reduction, *Waste treatment, Acetates, Acetone, Distillation, Methylene chloride, Organic compounds, Toluene, Trichloroethane, Waste disposal, Waste management, Xylenes.

The recovery and reuse of commercial solvents has become a major operating concern for the small-to-medium user of these materials in light of current Federal regulations. Pending regulations will severely limit these businesses in the manner in which they may treat, store, or dispose of these materials in the near future. A mobile solvent recovery system for reclaiming usable solvents and thereby minimizing the amount of waste generated has been developed and tested at a number of industrial sites. The system has been designed to be flexible enough to reclaim a wide variety of industrial solvents while still adhering to the EPA's regulations governing the quantities of wastes that remain within the system as residue, and minimizing the amount of cross-solvent contamination. The system employs a specially engineered vacuum distillation unit equipped with two cleaning systems for continuous cleaning of the side walls and dome head. The current progress of this project is discussed including the design and construction of the system and its operation. The wastes tested have consisted of sludges with solvents such as toluene, trichloroethane, n-propyl acetate, xylene, acetone, methylene chloride, and others. The results to date have been very promising and indicate that from 50-90% of the initial volume of these wastes may be reduced. They also indicate that reusable solvent may be obtained, thereby providing an economic, as well as a waste management incentive for on-site reclamation. (See also W91-06158) (Author's abstract)
W91-06167

MINIMIZING WASTE OIL DISPOSAL.
Earth Technology Corp., Alexandria, VA.
For primary bibliographic entry see Field 5E.
W91-06168

DEMETALLATION OF USED OIL TO FACILITATE ITS UTILIZATION AS A FUEL.
Auburn Univ., AL. Dept. of Chemical Engineering.
A. R. Tarrer, J. Kaminski, J. H. Kang, J. Parrish, and E. R. Bates.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 123-142, 4 fig, 19 tab, 8 ref. EPA Cooperative Agreement CR 812090 to Auburn University.

Descriptors: *Chemical treatment, *Demetallation, *Fuel, *Oil wastes, *Recycling, *Waste recovery, Diammonium phosphate, Filtration, Metallic borohydrides, Metals, Sedimentation.

Used oil invariably contains soluble and insoluble metal-bearing compounds. The presence of these compounds complicates the recycling of used oil as a fuel, by causing boiler maintenance problems and by making it difficult to comply with particulate emission standards and Resource Conservation and Recovery Act (RCRA) regulations. Demetallating a used oil before its burning minimizes maintenance problems and facilitates meeting the regulatory requirements controlling its burning. Different physical and chemical methods can be used to demetallate used oils. A chemical demetallation agent was used to convert entrained nonfilterable metals into a form that could be effectively removed by filtration. Two different types of chemical demetallation agents were used: metallic borohydrides (NaBH4 and KBH4) and diammonium phosphate (DAP). The activity and selectivity of these demetallation agents under different reaction conditions in various types and sizes of reactors (thereby varying mass transfer rates) were compared. Several types of used oils having different metal contents were examined. It was observed that metallic borohydrides were highly selective with regard to the types of metals they removed. The accompanying sludge formed also made the separation operation inefficient. On the other hand, results obtained with DAP were extremely favorable. The presence of water during the reaction played an important role as a carrier for the DAP, aiding in its dispersion and reducing the importance of mass transfer. This study, which also evaluated different separation techniques, found the use of both sedimentation and filtration to be practical, with filtration rates being significantly accelerated by the addition of low percentages of No. 2 fuel oil. (See also W91-06158) (Author's abstract)
W91-06169

WASTE OIL MANAGEMENT FOR A SMALL QUANTITY GENERATOR.
Fruehauf Corp., Detroit, MI.
For primary bibliographic entry see Field 5E.
W91-06170

EFFICIENCIES IN WASTE PROCESSING.
University of South Florida, Tampa. Dept. of Civil Engineering and Mechanics.
R. I. Stessel.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 153-162, 9 fig, 7 ref.

Descriptors: *Performance evaluation, *Separation techniques, *Waste management, *Waste recovery, *Waste treatment, Air pollution, Energy, Recycling, Solid wastes, Waste disposal.

Processing of solid waste involves quantification of the performance of separation devices. The concept of efficiency is difficult to define. The literature frequently makes use of recovery, but that can be very misleading since purity is left unaccounted for. Ideally, one would like to account for both purity and recovery in a single term. This becomes more cumbersome when one is dealing with n-way separators rather than restricting the discussion to binary separators. Results from this discussion are somewhat specific to air classification, although it is possible to generalize. With air classification, recovery was expressed in terms of the particle size distribution, the form of which was known from independent sources. The success achieved indicates the validity of the multiplication of recoveries, and taking a root equal to the number of recoveries in the mathematical expression used to calculate fractional separation efficiency. Calculation of efficiency based on the recoveries obtained at the outputs is then valid for any separation process. Different separation processes may not be able to make use of a well-known distribution of the feed. It is important for most unit operations that a robustness parameter be calculated, and it is possible that constituents of such a parameter will differ between unit operations. If the expression can be constituted so as to vary between zero and one, then it would be possible to multiply the efficiency and the robustness together so as to form a composite efficiency. (See also W91-06158) (Lantz-PTT)
W91-06171

HAZARDOUS WASTE VOLUME REDUCTION RESEARCH IN THE U.S. ENVIRONMENTAL PROTECTION AGENCY.
Environmental Protection Agency, Cincinnati, OH. Hazardous Waste Engineering Research Lab.
For primary bibliographic entry see Field 5E.
W91-06172

MAGNETIC SEPARATION OF URANIUM FROM WASTE MATERIALS.
Oak Ridge National Lab., TN.
J. M. Hoegler.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 172-189, 13 fig, 6 tab, 6 ref.

Descriptors: *Magnetic studies, *Radioactive wastes, *Separation techniques, *Uranium, *Waste treatment, Hazardous wastes, Magnesium fluoride, Magnetic compounds.

Criteria were developed for the selection of candidate wastes for testing the magnetic separation of uranium or other paramagnetic materials, or both. A survey of Department of Energy (DOE) hazardous wastes was conducted to determine good candidates for bench-scale magnetic separation tests. Representatives of 21 DOE sites were contacted, and materials were identified as potential candidates for magnetic separation. To date, seven samples have been obtained and tested for separability of uranium with a bench-scale magnetic assaying device. The samples tested have been obtained from the K-1401B and K-1401C ponds in Oak Ridge, TN; from waste piles in Maywood, NJ; from North and South Ponds in Richland, WA; and from magnesium fluoride drums in Fernald, OH. The magnetic device utilized in these tests can be used in a deflective mode with dry particulate samples or a matrix-gradient mode with either dry particulate or liquid-suspended materials. Uranium separation from magnesium fluoride has shown exceptionally good performance in both wet and dry systems and could be an important application of the technology. (See also W91-06158) (Author's abstract)
W91-06173

ELIMINATION OF PRECOAT FILTER SLUDGE HAZARDOUS WASTE.
Flexel Kansas, Inc., Tecumseh.
R. J. Kieffer.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 190-195, 2 fig.

Descriptors: *Filtration, *Hazardous wastes, *Industrial wastewater, *Separation techniques, *Sludge cake, *Waste treatment, Liquid cyclone process, Physical treatment, Sludge filters, Suspended solids.

Hazardous waste disposal regulations forced a reconsideration of process to recycle waste cellophane film and product quality requirements to eliminate the need to treat and dispose of a hazardous sludge containing flammable solvents. This resulted in a new liquid cyclone process to replace the precoat filter system, which generated hazardous waste sludge. Beside eliminating a complex, labor-intensive, material-wasting process, replacement of the precoat filter prevented further generation of ignitable hazardous waste. The new process, using liquid cyclones to make the required liquid-solids separation, must have a gas-free feed for efficient operation. Beneficial particle classification, a result of the cyclone process, improved material efficiencies and had no discernible negative effects on product quality. The liquid cyclone system designed to separate suspended solids from a polymer solution, and its interrelation with the contiguous processes are described in this paper. Polymer solution flows by gravity from the extractor weir box at a rate of 220 cu mm/sec (3.5 gpm) into the suction side of the cyclone circulation pump. This pump circulates polymer solution at a rate of 1260 cu mm/sec (20 gpm) through the cyclones and back to the feed sump where 220 cu mm/sec (3.5 gpm) is drawn off and the balance recycles back to the cyclones. The cyclones are run in series primarily to provide backup capacity for the first unit, which accomplishes just about all of the separation. The bottom flow, 63 cu mm/sec (1 gpm) per unit, containing the suspended solids from each cyclone, is discharged to the extractor. (See also W91-06158) (Lantz-PTT)
W91-06174

UTILIZATION OF ASH PRODUCTS FROM COMBUSTION OF SHREDDED SOLID WASTE.
Energy Answers Corp., Albany, NY.
For primary bibliographic entry see Field 5E.
W91-06175

MICROBIOLOGY OF DRINKING WATER TREATMENT: RECLAIMED WASTEWATER.
Pretoria Univ. (South Africa). Dept. of Medical Virology.
For primary bibliographic entry see Field 5F.

W91-06203

WATER HYACINTH GROWTH IN ANAEROBIC DIGESTER EFFLUENTS.
Florida Univ., Gainesville. Dept. of Soil Science.
K. K. Moorhead, D. A. Graetz, and K. R. Reddy.
Biological Wastes BIWAED, Vol. 34, No. 2, p 91-99, 1990. 1 fig, 4 tab, 15 ref.

Descriptors: *Advanced wastewater treatment, *Water hyacinth, Ammonium, Anaerobic digestion, Effluents, Nitrogen, Plant growth, Secondary wastewater treatment, Wastewater, Wastewater treatment.

Anaerobic digestion of plant biomass, animal waste or sewage sludge generates a waste by-product that must be disposed of, or preferably utilized to reduce the cost of energy production. The waste by-product consists of digested sludge and effluent. The effluent composition of anaerobic digesters varies with the type of feedstock used. Growth characteristics and N assimilation of water hyacinth (Eichhornia crassipes (Mart) solms) were evaluated for diluted and undiluted effluents from anaerobic digesters containing 15N-labeled water hyacinth as feedstock. The diluted effluents were an excellent growth media for plants and resulted in high dry weight gains. The highest gain in plant dry weight (18 g/square m/day) was noted for the diluted effluent having an initial NH4-N concentration of 65 mg/L and an electrical conductivity of 1.6 decasiemen/m. Plant death was observed in four of the six undiluted effluents. Ammonium loss from the effluents was described with first-order kinetic rate constants that ranged from 0.175 to 0.593/day. Plant assimilation of 15NH4-N ranged from 36 to 66% in diluted effluents and from 2 to 77% in undiluted effluents. Plant survival was not dependent entirely on NH4-N concentrations or electrical conductivity of the effluents. (Mertz-PTT)
W91-06222

CORRECTED METHOD FOR DRY MATTER DETERMINATION FOR USE IN ANAEROBIC DIGESTER CONTROL.
Guelph Univ. (Ontario). School of Engineering.
G. Hayward, and V. Pavlicik.
Biological Wastes BIWAED, Vol. 34, No. 2, p 101-111, 1990. 1 fig, 3 tab, 11 ref.

Descriptors: *Anaerobic digestion, *Volatile solids, *Wastewater analysis, *Wastewater treatment, *Water analysis, Acetic acid, Ammonia, Carbon dioxide, Comparison studies, Drying, Effluents, Methane, Sulfuric acid, Titration.

The amounts of volatile solids in the feed and effluent of a methane producing anaerobic digester are commonly used to describe the capacity and conversion efficiency of the digester. The volume yield of methane is often reported as cubic m/kg of volatile solids added to the digester. The reduction in volatile solids is also reported to complete the digester mass balances. Unfortunately, mass balances based on the volatile solids reduction are rarely close. The loss of biologically active material such as acetic acid during the standard dry matter determination can introduce substantial error into anaerobic digester mass balances. This error may be compensated by performing the determination on a sample after titration with sulfuric acid or sodium hydroxide. Data from a variety of materials obtained using the combined titration and drying methods were compared with results from the standard method. The loss of volatile material during drying was confirmed and the two titration corrections validated. Acetic acid, carbon dioxide and ammonia are lost from anaerobic digester influent and effluent samples during drying at 105 C. The sulfuric acid titration is recommended due to its simplicity and the additional alkalinity information obtained. The acid titration method is also less subject to titration error and interference than is the base titration method. (Mertz-PTT)
W91-06223

UPGRADING AN AERATED LAGOON TO A SEQUENCING BATCH REACTOR FOR PIGGERY WASTE TREATMENT.
Hong Kong Polytechnic, Kowloon. Dept. of Civil and Structural Engineering.
S. H. Wong, M. W. Wu, and C. C. Choi.
Biological Wastes BIWAED, Vol. 34, No. 2, p 113-122, 1990. 2 fig, 6 tab, 5 ref.

Descriptors: *Aerated lagoons, *Animal wastes, *Wastewater treatment, Biological oxygen demand, Farm wastes, Hogs, Hong Kong, Suspended solids, Wastewater reactors, Water pollution prevention.

In Hong Kong, there are over half a million pigs kept in small domestic farms with herd sizes of a few hundred. Many of the wastes generated by these pigs are hosed out directly into the nearby streams and thus cause a major water pollution problem. Farm washings containing piggery wastes are so dilute that they are not very suitable for biogas production in a conventional anaerobic digester. Therefore, aerobic treatment might be employed if the pollution potential of these bulky piggery slurries is to be reduced before they are discharged into surface waters. An aerated lagoon system treating dilute piggery waste to an effluent standard of biological oxygen demand of about 200 mg/L and suspended solids of 400 mg/L was upgraded. A laboratory study indicated that a continuous-flow, aerated lagoon system could be operated as a sequencing batch reactor with improved performance. The aeration basin of the lagoon system, with a working volume of about 60 cubic m, was then converted to a sequencing batch reactor treating waste arising from an equivalent of 200 porkers. The modifications were simple and inexpensive, but the performance of the system was greatly improved. The new system consistently produced very good quality effluent with both biological oxygen demand and suspended solids concentrations well below 50 mg/L. The surplus activated sludge produced was stable and required no further treatment before dewatering and disposal. (Mertz-PTT)
W91-06224

PSYCHROPHILIC ANAEROBIC DIGESTION OF ANIMAL MANURE: PROPOSED DESIGN METHODOLOGY.
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. M. Safley, and P. W. Westerman.
Biological Wastes BIWAED, Vol. 34, No. 2, p 133-148, 1990. 1 fig, 3 tab, 53 ref.

Descriptors: *Anaerobic digestion, *Animal wastes, *Temperature effects, Biogas, Load distribution, Manure, Methane, Psychrophilic temperatures, Waste treatment.

Typically, anaerobic digesters are designed to operate in either the mesophilic (20-45 C) or thermophilic (45-60 C) temperature ranges to maintain high-rate, steady-state digestion. Higher temperatures allow higher loading rates and thus smaller digesters. However, methanogenesis has been observed at temperatures approaching 0 C. The anaerobic decomposition of organic matter at low temperatures (<20 C) is referred to as psychrophilic anaerobic digestion. Anaerobic digestion at psychrophilic temperatures has not been as extensively explored as that occurring at either mesophilic or thermophilic temperature ranges. A comprehensive literature review was conducted on psychrophilic anaerobic digestion and design of anaerobic digesters for treating animal manures. Anaerobic digestion of caged layer manure was studied in the laboratory at low temperatures (14-23 C). The digesters were operated to determine combinations of temperature and loading rate that gave acceptable methane yield. Acceptable methane yield was obtained for loading rates ranging between 0.14 kg volatile solids/cubic m day at 14 C and 0.57 kg volatile solids/cubic m day for 23 C. The resulting data along with that taken from similar tests documented in the literature was found to approximate the van't Hoff-Arrhenius equation. Using this relationship, an acceptable loading rate for a digester operated at 20 C would be approximately 40% of that used for a digester operating at 30 C. This equation is suggested as a technique for determining suitable loading rates for psychrophilic digesters based on data for digesters operated at higher temperatures. (Mertz-PTT)

W91-06225

COMMUNITY SELF-FINANCING OF WATER SUPPLY AND SANITATION: WHAT ARE THE PROMISES AND PITFALLS.
Water and Sanitation for Health Project, Arlington, VA.
For primary bibliographic entry see Field 5F.
W91-06244

CARBON-14 TRACER STUDY OF POLYACRYLATE POLYMER IN A WASTEWATER PLANT.
Michigan Univ., Ann Arbor. School of Public Health.
J. E. Martin, T. Stevens, G. E. Bellen, L. W. King, and J. M. Hylko.
International Journal of Radiation Applications & Instrumentation. A, Appl. Radiation & Isotopes ARISEF, Vol. 41, No. 10/1, p 1165-1172, 1990. 7 fig, 2 tab, 6 ref.

Descriptors: *Carbon radioisotopes, *Polymers, *Radioactive tracers, *Wastewater treatment, Pollutants, Primary wastewater treatment, Tracers, Water pollution sources.

A number of highly absorbent consumer products are currently being developed which use fiber components to which highly absorbent polymers are added. The high absorbency of these products without large bulk may make these products very popular, leading to a number of questions on the environmental effects of their disposal. The discharge of such products into on-site wastewater treatment systems such as septic tanks or aerobic treatment systems has, on occasion, been alleged to cause upset or failure of these systems. Upset or failure of these systems could result in unacceptable discharges of pollutants; thus, it is important to assess the fate and effect of these products when they are disposed into on-site wastewater systems. A highly absorbent consumer-product, polyacrylate-polymer material tagged with carbon-14, was dosed to a standard on-site aerobic wastewater treatment plant which contained a settling chamber, an aeration chamber, and an effluent chamber. Operation of the test plant was essentially the same as that of a control plant even under exaggerated conditions. About 97% of the polymer material was retained in solids deposited in the primary and aeration chambers, and effluent releases were minimal. The use of a 14C tagging procedure proved to be a successful method for studying the behavior of these complex materials. It may be useful to conduct a further study on retained solids to determine whether microbial decomposition of the polymer material occurs while they remain in typical plants. (Mertz-PTT)
W91-06245

SEASONAL SUCCESSION OF ALGAL PERIPHYTON FROM A WASTEWATER TREATMENT FACILITY.
Vermont Univ., Burlington. Dept. of Botany.
L. S. Davis, J. P. Hoffmann, and P. W. Cook.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 611-617, 1990. 4 fig, 2 tab, 41 ref.

Descriptors: *Algal growth, *Biological wastewater treatment, *Periphyton, *Wastewater treatment, Clarifiers, Flow velocity, Light effects, Nutrients, Seasonal variation, Species diversity, Temperature effects.

Many sewage treatment processes utilize a step in which particulate matter is removed by settling in secondary clarifying tanks. The nutrient-rich supernatant flows over the weirs of these tanks and is disinfected before returning to the environment. Approximately 60% of the total influent nitrogen and 70% of the total influent phosphorus remain in the final effluent. The clarifying tanks are open and the combination of high nutrient loads, flowing water, and daylight permit the development of extensive periphyton communities. The potential for rapid algal growth in these hypereutrophic systems has promoted recent interest in using periphyton communities for biological treatment of

wastewater. Attached algal populations were sampled at weekly or biweekly intervals to characterize successional changes in the secondary clarifiers of a wastewater treatment plant. Three communities were compared from areas of slow, medium and rapid current velocities. In general, the algae resembled those reported for other hypereutrophic flowing waters. Of the 23 algae recorded, Stigeoclonium, Oedogonium, Oscillatoria, Lyngbya, and Pleurocapsa were dominant at some point in the 15 month sampling period. Nutrient concentrations were consistently high; therefore, changes in temporal distribution of algae were probably dependent on seasonal changes in light and temperature. Colonization of artificial substrates was also observed. Small unicellular algae were the first autotrophs to attach and these were followed by larger filamentous forms. (See also W91-06253) (Mertz-PTT)
W91-06252

PRODUCTION AND NUTRIENT ACCUMULATION BY PERIPHYTON IN A WASTEWATER TREATMENT FACILITY.
Vermont Univ., Burlington. Dept. of Botany.
L. S. Davis, J. P. Hoffmann, and P. W. Cook.
Journal of Phycology JPYLAJ, Vol. 26, No. 4, p 617-623, 1990. 5 fig, 3 tab, 40 ref.

Descriptors: *Algal growth, *Biological wastewater treatment, *Periphyton, *Tertiary wastewater treatment, *Wastewater treatment, Biomass, Chlorophyll a, Clarifiers, Nutrient removal, Phosphorus, Productivity, Seasonal variation.

Wastewater treatment facilities utilizing outdoor secondary clarifiers support extensive growth of attached algae. Although periphyton is conspicuous in this hypereutrophic environment, literature on algal productivity within wastewater treatment systems is scarce. Five growth experiments were conducted over a 15-month period to quantify biomass, seasonal growth rates, and production of a periphyton community in the secondary clarifier of a wastewater treatment plant. A maximum periphyton biomass of 130 g/square m (ash-free dry weight) was achieved during fall. Growth rates of approximately 0.23/day (from chlorophyll a) were observed during spring, summer and fall. Winter values were also high (0.20/day). Maximum production was approximately 22 g/square m/day during spring. Periphyton phosphorus content was variable ranging from 0.4-2.4% and nitrogen content varied from 4.4-15.1%. Estimated maximum removal rates of both nutrients were high (up to 160 mg P/square m/day and 1900 mg N/square m/day). High productivity and nutrient removal rates in this lotic hypereutrophic ecosystem may warrant further investigation of periphyton as a tertiary biological wastewater treatment in cold climates. (See also W91-06252) (Mertz-PTT)
W91-06253

SOLID/LIQUID SEPARATION: WASTE MANAGEMENT AND PRODUCTIVITY ENHANCEMENT.
Battelle Press, Columbus, Ohio. 1990. 572p. Edited by H. S. Muralidhara.

Descriptors: *Dewatering, *Filtration, *Separation techniques, *Sludge digestion, *Waste management, *Wastewater treatment, Acoustics, Coagulation, Electrochemistry, Flocculation, In situ treatment, Land application, Membrane techniques, Recycling, Sludge thickening, Soil contamination, Ultrafiltration.

The second conference on Recent Advances in Solid/Liquid Separation held in December 1989 highlights the interdisciplinary nature of solid/liquid separation processes, namely geochemistry, colloidal science, flow-through process media, and petroleum, mechanical, and chemical engineering. Papers from the conference are presented under eight broad categories: process fundamentals of sludge dewatering; novel dewatering processes; industrial coal and mineral wastes; flocculation; in situ remediation of contaminated soils; beneficial reuse of sludges; electrotechnologies; and membranes and membrane presses. The conference also focussed on environmental issues, specifically the Superfund sites, the Garbage Barge, and the increasing denial of land disposal requests. The section on sludge dewatering highlights batch thickening, sludge and wastewater filtration, optimizing polymer consumption in sludge dewatering applications, thin cake filtration, and electro-optic studies of concentration banding in particulate media. Novel dewatering processes discussed are the ten-minute digestion, natural freeze-thaw, Tyvek microfiltration, and decanting and filtration in a high-gravity centrifugal dryer. The dissolved air, induced air, and nozzle air flotation systems are compared for precipitation-flotation of metal-laden wastewaters. Other technologies demonstrate how industrial wastewaters and sludges may be recycled and reused. Among the electrotechnologies discussed are alternating current electrocoagulation, electrochemical reactor systems for metal recovery and detoxification, ultrasonic interactions during sludge dewatering, electroacoustic dewatering of sewage sludges, and particle separations by the electrocoal process. Membrane technologies offer a novel approach to antifouling, waste minimization and recycling with membrane filter presses, and new approaches to pollution control. (See W91-06422 thru W91-06460) (Geiger-PTT)
W91-06421

CHANNELLING AND THE DOUBLY CONCAVE FLUX CURVE IN BATCH THICKENING.
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
P. A. Vesilind, and G. N. Jones.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 3-16. 10 fig, 19 ref.

Descriptors: *Channeling, *Dewatering, *Separation techniques, *Sludge thickening, *Wastewater treatment, Fluctuations, Mathematical studies, Sedimentation, Settleable solids, Slurries.

The thickening of two calcium carbonate sludges was studied in large transparent cylinders to examine the cause of the doubly concave flux curve. The sludge was pumped into the cylinders from the bottom and allowed to thicken without stirring. The interface drop and channels were observed through the cylinder walls. All of the channels that formed during thickening were small (4 cm or less in length and about 0.1 cm wide), and they moved slowly upward as a fairly even layer over the course of the experiment. The graphically determined interfacial settling velocities measured using batch tests were multiplied by the initial concentration to yield the solids flux graph. Examination of these data showed that the second concavity in the flux curve appeared to exist between 500 and 800 g/L with a peak at about 650 g/L. To contrast with this normal method of measuring interface velocity, the initial velocity was determined, and the resulting flux was plotted. Since this latter interface velocity is from early in each test, the calculated flux may be more representative of a given concentration than are later interface velocity measurements that might include differential settlement of the solids and the progressive dilution of the upper sludge column. Thus channelling is not directly responsible for the doubly concave flux curve, and the curve in fact results from the incorrect interpretation of batch thickening data. (See also W91-06421) (Geiger-PTT)
W91-06422

SLUDGE AND WASTEWATER FILTRATION: A CONTINUUM ANALYSIS.
Akron Univ., OH. Dept. of Chemical Engineering.
G. G. Chase, M. S. Willis, and I. Tosun.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 17-30. 2 fig, 5 tab, 19 ref.

Descriptors: *Dewatering, *Filtration, *Mathematical models, *Sludge treatment, *Wastewater treatment, Filter media, Separation techniques, Sludge filters.

A multiphase continuum analysis was used as an alternative to the ad hoc approach for the design of filters for wastewater and sludge treatment. The systematic approach normally reserved for single-phase systems was extended to dispersed multiphase material systems and provided alternate modes of operation to those used with the ad hoc approach. The continuum approach focused on the clogging of the filter medium by the cake particles and suggested that altering of the aggregate structure of the solid particles by prefiltration operations is not independent of the selection of the filter medium. Both must be taken into consideration to obtain favorable filtration rates. The continuum approach was applied to cake filtration, and the resulting working equation was compared with the two-resistance model currently used to evaluate filter cakes. The comparison indicated that the continuum approach provides novel methods of operation, namely constant cake pressure drop, and constant applied pressure at a constant rate. The continuum approach can also be applied to the deep bed clarifier with different boundary conditions between the multiphase regions. (See also W91-06421) (Geiger-PTT)
W91-06423

OPTIMIZING POLYMER CONSUMPTION IN SLUDGE DEWATERING APPLICATIONS.
ZENON Water Systems, Inc., Burlington (Ontario).
P. M. Crawford.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 31-40. 8 fig, 5 ref.

Descriptors: *Dewatering, *Sludge conditioning, *Sludge thickening, *Sludge treatment, *Wastewater treatment, Optimization, Performance evaluation, Polymers, Process control, Sludge drying.

The Sludge Conditioning Controller (SCC) was designed to upgrade sludge dewatering operations during wastewater treatment by monitoring polymer dosage during sludge conditioning. The SCC determines the state of sludge conditioning directly by measuring the intrinsic rheological characteristics of both conditioned and unconditioned sludge. The hardware for an SCC consists of a central control panel, local control station, sample vessel and sensor head, and a printer. The control algorithm compares the present state of conditioning with the reference point of known satisfactory conditioning obtained during the tuning cycle. If the present state of conditioning is either satisfactory or better than satisfactory, then the algorithm directs the polymer flow signal to be reduced. If, on the other hand, the present state of conditioning is not satisfactory, then the algorithm directs the polymer flow signal to be increased. The SCC determines the present state of conditioning by analyzing the sample of conditioned sludge and finding the peak value of the torque versus time data. In municipal plant operation, the range of solids concentrations on which the SCC has worked successfully is from about 0.3% for waste-activated sludges up to about 7% for anaerobically digested sludges. Based solely on polymer savings, the payback period for the SCC ranges from about 4 months to 4 years, with an average of about 1.5 years, depending on the pre-SCC polymer consumption. (See also W91-06421) (Geiger-PTT)
W91-06424

THIN CAKE FILTRATION: THEORY AND PRACTICE.
Millipore Corp., Bedford, MA.
K. S. Cheng.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 41-50. 5 fig, 7 ref.

Descriptors: *Filter media, *Filtration, *Separation techniques, *Wastewater treatment, Slurries, Theoretical analysis.

Thin cake filtration (TCF) is a useful technique for improving the filtration rate for a certain class of slurries. Contrary to conventional filtration in which cake deposits accumulate continuously during the filtration process, TCF controls cake

growth by maintaining mechanical agitation close to the filter medium surfaces. The shear-compacted thin cake, only 2 mm thick, serves as a permanent precoat, delivering high rate and clear filtrates. Mechanical forces break down flocculated particulate structures, producing filter cakes with high solids content. Shear consolidation and particle binding of the thin cakes provides a plausible explanation of the mechanisms of TCF. Filter cakes with thixotropic properties such as clay, calcium carbonate, metal hydroxides, metal oxides and pigment generally run very well in thin cake filters. The particle size of these slurries ranges from 0.8 to 10 microns. In addition to pressure and temperature, TCF is affected by a change in solids concentration, the rotating speed of the turbine, and the filter media. (See also W91-06421) (Geiger-PTT)
W91-06425

ELECTRO-OPTIC STUDIES OF CONCENTRATION BANDING IN PARTICULATE MEDIA.
Reading Univ. (England). J.J. Thomson Physical Lab.
B. R. Jennings, R. Isherwood, and M. Stankiewicz.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 51-61. 4 fig, 19 ref.

Descriptors: *Clays, *Electrophoresis, *Particulate matter, *Separation techniques, *Waste treatment, *Wastewater treatment, Emulsions, Kaolinite, Mathematical studies.

A phenomenon has been observed in which particles in suspension associate into highly concentrated bands that arrange themselves perpendicular to the field lines of uniform electric fields. These bands concentrate with time and field strength and are optimized for given field frequencies. They only form in alternating electric fields and are in opposition to the well-known fields. Electric birefringence and electrophoretic light scattering measurements have been made to demonstrate the tendency of pearl chains to be associated with the electrical polarizability, whereas banding is predominantly associated with electrophoretic mobility of the particles. The generality of the effect is shown by its existence in various emulsion systems and rod and disk-like particles. (See also W91-06421) (Author's abstract)
W91-06426

STATE OF WASTEWATER TREATMENT INDUSTRY IN THE NETHERLANDS.
Hollandse Eilandenen Waarden Wastewater Authority, Dordrecht (Netherlands).
H. A. Meijer.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 65-82. 9 fig, 8 tab, 3 ref.

Descriptors: *Incineration, *Sludge disposal, *Tertiary wastewater treatment, *The Netherlands, *Wastewater treatment, Cost analysis, Nitrogen removal, Nutrient removal, Phosphates, Phosphorus removal.

In the last 20 years, an ambitious sewage treatment plant investment program was executed in The Netherlands. The load to surface waters of oxygen-consuming substances was reduced from 40 million to 5 million population equivalents. Different wastewater treatment systems used in the Netherlands include oxidation ditches, one-stage activated sludge plants, trickling filter plants, two-stage biological plants, and primary treatment plants. In Rotterdam-Dokhaven a peculiar underground two-stage sewage treatment plant is in operation. As conditions for agricultural application of sewage sludge and other forms of reuse become more stringent, incineration of sludge seems to be the only alternative method of disposal. Since 1985, phosphate removal of effluents was implemented at sewage treatment plants according to the Rhine Action Program. In the first stage of the program the P standard will be 2 mg/L, and the nitrogen standard, expressed in N-total, will be 20 mg/L. Recent studies in the Netherlands show that these stringent effluent standards can best be reached by designing an oxidation type treatment plant using post-precipitation of phosphate. Extra costs for extreme P and N removal are high: investment costs increase 60% and yearly costs 50%. Future research coordinated by the STORA Foundation and the Ministry of Transport and Public Works in the Future Generation Wastewater Treatment Works (RWZI 2000) program focuses on wastewater treatment, sludge production and sludge treatment, and fundamentals of sludge dewatering. (See also W91-06421) (Geiger-PTT)
W91-06427

CENTRIFUGE THICKENING: FULL-SCALE TESTING AND DESIGN CONSIDERATIONS.
Montgomery (James M.) Consulting Engineers, Inc., Pasadena, CA.
G. S. MacConnell, D. S. Harrison, K. W. Kirby, H. Lee, and F. Mousavipour.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 83-108. 17 fig, 4 tab, 4 ref.

Descriptors: *California, *Centrifugation, *Comparison studies, *Dewatering, *Los Angeles, *Sludge thickening, *Wastewater treatment, Activated sludge treatment, Design criteria, Performance evaluation.

The City of Los Angeles installed four high-capacity thickening centrifuges at the City's Hyperion Treatment Plant in 1988 to provide interim waste-activated-sludge thickening capacity and provide a full-scale test for the comparison of the Humboldt-Wedag centrifuge and the Sharples centrifuge. The performance test of both the Humboldt-Wedag and Sharples centrifuges, with and without polymer, yielded considerably different results with respect to each centrifuge. The two main operational variables for the Humboldt-Wedag machine were sludge feed rate and nozzle size. An increase in feed rate resulted in a decrease in both the capture efficiency and concentrate quality. With the Sharples machine, sludge feed, differential speed, and polymer addition were all effective operational parameters. The addition of polymer drastically increased the effective capacity of the centrifuge and improved all measurable performance parameters. The Sharples machine is relatively sensitive to operational conditions. A minor change in the feed sludge volume index or solids concentration can significantly affect the machine's performance. The Sharples machine must be monitored and operational adjustments made to optimize the machine with changes in sludge feed conditions. The sensitivity of the machine is beneficial in that the machine may be adjusted to a desired level of performance. The Sharples machine was 30 to 50% more energy efficient than the Humboldt-Wedag machine, dependent on the sludge feed rate. The Sharples machines were more reliable than the Humboldt-Wedag machines when measured as a group. However, the most reliable Humboldt-Wedag machine was more reliable than the least reliable Sharples machine. Corrosion was noticed on Humboldt-Wedag components. No corrosion was noticed on the Sharples machines. (See also W91-06421) (Geiger-PTT)
W91-06428

TEN-MINUTE DIGESTION.
Hach Co., Loveland, CO.
D. E. Gustafson.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 110-114. 2 tab.

Descriptors: *Domestic wastes, *Heavy metals, *Nitrogen, *Pollutant identification, *Sludge digestion, *Wastewater treatment, Colorimetry, Hydrogen peroxide, Manganese, Nickel, Phosphorus, Separation techniques, Silver, Sulfuric acid, Zinc.

The Hach Digesdahl system of ten-minute sludge digestion was evaluated on reference sewage sludge of domestic origin. The Hach Digesdahl apparatus, consisting of a heater assembly, heat shield, fractionating column and filter pump (aspirator), was used for sample digestion. The fractionating column fits into the mouth of the digestion flask; hydrogen peroxide addition is controlled with a pump and timer. The Digesdahl apparatus was used to digest 15 replicate samples of the Community Bureau of Reference (BCR No. 144) Sewage Sludge Domestic sample. Results for aluminum, copper, manganese, nickel, nitrogen, phosphorus, silver, and zinc were compared by a colorimetric procedure with certified and indicative values obtained by the Commission of the European Communities analysts. Results obtained in most of the domestic origin sludge reference material tests were quite comparable. Based on this study, the Hach Digesdahl system would be the method of choice because of analysis speed, reduced system costs, and option of analyzing for minerals and metals with the same sample digest. (See also W91-06421) (Geiger-PTT)
W91-06429

SLUDGE DEWATERING BY NATURAL FREEZE-THAW.
Cold Regions Research and Engineering Lab., Hanover, NH.
C. J. Martel.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 115-122, 2 fig, 6 tab, 9 ref.

Descriptors: *Dewatering, *Freeze-thaw tests, *Sludge thickening, *Sludge treatment, *Wastewater treatment, *Water treatment, Aerobic digestion, Anaerobic digestion, Separation techniques.

The dewaterability of freeze-thaw conditioned sludges and how well they drain at various depths were measured on anaerobically digested and aerobically digested sludges obtained from typical water treatment operations. Specific resistance tests and capillary suction time values were performed before and after freeze-thaw tests. Drainage tests were conducted at four depths ranging from 30 to 220 cm in clear cast acrylic columns. Drying tests were also performed on the aerobically digested sludge to see how long it would take to dry to a 20% solids content. Results showed that capillary suction time is a better indicator than specific resistance for evaluating the dewaterability of freeze-thaw conditioned sludges. The depth of sludge that can be applied to a freezing bed is not limited by drainability, at least to a depth of 2.0 m. Since all sludges drained easily at 2.0 m, even greater depths may be possible. The solids content in freeze-thaw conditioned water treatment and anaerobically digested sludges is high enough to allow mechanical removal immediately after drainage is complete. Further drying is not needed. However, aerobically digested sludge may require a 2-to 3-week drying period before it can be removed. (See also W91-06421) (Geiger-PTT)
W91-06430

TYVEK MICROFILTRATION OF HAZARDOUS WASTEWATERS.
Du Pont de Nemours (E.I.) and Co., Newark, DE. Engineering Dept.
E. Mayer.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 123-133. 10 tab, 11 ref.

Descriptors: *Filter media, *Filtration, *Hazardous materials, *Hazardous wastes, *Heavy metals, *Microfiltration, *Wastewater treatment, Barium, Groundwater pollution, Industrial wastes, Metal-finishing wastes, Separation techniques.

A new filter media based on Tyvek flash spinning technology was developed that has an asymmetric pore structure, a greater number of submicron pores, and a smaller average pore size. As a consequence, it has superior filtration properties, longer life, and in many instances can compete with microporous membranes, PTFE laminates, and various melt-blown media. When coupled with an Oberlin automatic pressure filter (APF), it provides an automatic wastewater filtration process that is a dry-cake alternative to conventional cross-flow microfilters and ultrafilters. The Tyvek/Oberlin APF process has proved extremely useful in filtering heavy metal and other hazardous wastewaters to meet strict EPA National Pollution

Discharge Elimination System (NPDES) discharge limits. The Tyvek/Oberlin APF matched all competitive media in rate and filtrate turbidity on Savannah River simulated plating waste, but produced a drier cake because of better air flow due to less media blinding. On actual Savannah River operation, the Tyvek APF units fouled less than conventional ultrafiltration/reverse osmosis combinations while giving good aluminum and uranium removal. The new filter media also performed well on electronics manufacturing plant wastewater, electronics plant cartridge replacement filter media, a munition plant wastewater to remove heavy metals before landfilling, clarifier underflow heavy metals removal, and battery manufacturing heavy metals removal. The Tyvek/Oberlin APF system removed barium from a contaminated groundwater leachate to prevent fouling in downstream organics removal equipment. The high strength coupled with the tight (1 micron) nominal pore structure led to Tyvek's use in the EPA Superfund Site-3 program. (See also W91-06421) (Geiger-PTT)
W91-06431

DECANTING AND FILTRATION IN A HIGH-GRAVITY CENTRIFUGAL DRYER.
Coal Technology Corp., Bristol, VA.
L. B. Smith, and R. A. Wolfe.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 135-145. 6 fig, 1 ref.

Descriptors: *Centrifugation, *Coal mine wastes, *Dewatering, *Filtration, *Separation techniques, *Sludge drying, *Wastewater treatment, Filter media, Flotation.

To address the need for an energy efficient and environmentally acceptable clean coal fines dryer, a new dewatering method was developed that employs decanting in combination with very high gravity centrifugal filtration in a batch process. The new process prevents filter blinding by employing the combination of a carbon fiber composite bowl and a highly efficient, variable frequency, alternating current drive to conserve the energy used in accelerating and decelerating the bowl. The new drying method may perform well in applications other than coal fines drying in which the particulate to be dewatered retains its integrity of shape under fairly high pressures and where an excessive amount of very fine leaf-like structures is not present in the product. Initial prototype results indicate the economics of the dewatering method are good and the dynamic considerations were met with a 0.914-m diameter fully automatic centrifuge operating with a 145-second cycle time and producing 7.26 metric tons/hr of dry coal from a froth flotation product. Commercialization is planned in the near future. (See also W91-06421) (Geiger-PTT)
W91-06432

DISSOLVED AIR, INDUCED AIR, AND NOZZLE AIR FLOTATION SYSTEM PERFORMANCE COMPARISON FOR PRECIPITATION FLOTATION OF METAL-LADEN WASTEWATERS.
Argonne National Lab., IL. Energy Systems Div.
R. W. Peters, and G. F. Bennett.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 161-189. 8 fig, 4 tab, 18 ref.

Descriptors: *Chemical precipitation, *Flotation, *Industrial wastewater, *Separation techniques, *Wastewater treatment, Copper, Heavy metals, Lead, Nickel, Performance evaluation, Zinc.

The performance of combined chemical precipitation/air flotation treatment has been addressed for two wastewaters employing three different air flotation systems: dissolved air flotation (DAF), induced air flotation (IAF), and nozzle air flotation (NAF). Two wastewaters, one synthetic and one industrial, were used in these performance assessments. The synthetic wastewater used Jayfloc-806 as the chemical collector, and the industrial wastewater used Jayfloc-824 as the collector. The synthetic wastewater was capable of removal efficiencies exceeding 96%. The DAF system provided the best metal removal (Zn, Cu, Pb, and Ni), and the NAF system, the poorest metal removal. For the industrial wastewater, removal efficiencies were lower, on the order of 75%. For lower collector dosages, use of the DAF system resulted in the lowest residual concentrations, whereas at higher dosages (about 5 mg/L), use of the IAF system resulted in the lowest concentrations. Enhancement ratios were much greater for the industrial wastewater (compared with the synthetic wastewater). (See also W91-06421) (Author's abstract)
W91-06433

SOLID/LIQUID SEPARATION IN WASTE ACID NEUTRALIZATION: A CASE STUDY.
Ebasco Services, Inc., Chicago, IL.
R. Venkateswar.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 191-200. 1 fig, 7 tab, 9 ref.

Descriptors: *Filtration, *Metal-finishing wastes, *Neutralization, *Sedimentation, *Separation techniques, *Wastewater treatment, Bases, Comparison studies, Dewatering, Flocculation, Hydrogen ion concentration, Lime, Sulfuric acid.

The performance of commonly used alkalis for neutralizing a typical waste sulfuric acid was evaluated in bench-scale experiments performed with different concentrations of a waste sulfuric acid from pickling operations. The initial concentration of the waste acid was 12% (measured as sulfuric acid). A portion of this was diluted to 2.5% and 5% acid. A known volume (500 ml) of the waste acid was treated with one of the following alkalis to a pH of 9.5 to 10.5: 50% NaOH solution; 50% Mg(OH)2 slurry; solid Ca(OH)2 slurry; 15% Ca(OH)2; or solid CaO. In most cases, neutralization to pH 9.5 to 10.5 was achieved within 30 to 60 minutes. In the case of Mg(OH)2 neutralization, a pH greater than 6.8 could not be achieved within a reasonable time period without adding a 50% NaOH solution. The resulting slurries were tested for filterability, the amount of solids generated, and settling. Neutralized waste filtered best when solid CaO or Ca(OH)2 was used. Waste acid neutralized with NaOH filtered poorly. Filtration was fairly rapid with Mg(OH)2 but in the case of the 5.1% acid, filtration was slow because a large amount of NaOH had been used along with Mg(OH)2 to achieve a pH of 0.5 to 10.5. The choice of alkali did not affect the quality of the filtrate after dewatering. No solids precipitated upon neutralizing 12% reagent acid with 50% NaOH solution. Solids generated through lime neutralization settled faster than those generated from using 50% NaOH or 50% Mg(OH)2. The alkali cost for 15% Ca(OH)2 was highest of the methods studied because of the additional cost for transporting water. (See also W91-06421) (Geiger-PTT)
W91-06434

MECHANICAL AND THERMAL TREATMENT OF DREDGED MATERIAL TO PRODUCE CERAMIC PELLETS.
Battelle-Inst. e.V., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 5E.
W91-06435

TOTAL RECYCLING OF WASTEWATER IN WET PROCESS PHOSPHORIC ACID PRODUCTION.
IMC Fertilizer, Inc., Mulberry, FL.
R. R. Stana.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 227-238. 6 fig, 5 tab, 7 ref.

Descriptors: *Fertilizers, *Gypsum, *Phosphorus compounds, *Recycling, *Wastewater reuse, *Water reuse, Ammonia, Cooling ponds, Fluorides, Nitrogen compounds, Phosphates, Salts, Sulfates.

A large facility for the production of wet process phosphoric acid and associated fertilizer products has been operated in central Florida since the early 1970's. To operate without a wastewater discharge, water balance and salt or impurity balance is carefully monitored. A properly designed plant and cooling pond can be operated with no discharge from the cooling pond if the pond has enough surge capacity to accommodate the seasonal rainfall pattern. The overall pond-gypsum-stack plant complex is capable of consumign or evaporating more water than it is expected to receive. A computer program was designed to manage pond water balance. The computer program can warn of excessive water input by the plant and steps can be taken to reduce water input from plant operations. Excessive precipitation caused by hurricanes is accommodated by an overflow pond. Pond water analysis shows major inputs of P2O5, fluoride compounds, sulfates, sodium, nitrogen compounds, and iron ammonia phosphate formation. Most of these impurities are precipitated or recovered for reuse. (See also W91-06421) (Geiger-PTT)
W91-06436

OVERVIEW OF SEPARATION TECHNOLOGIES DEMONSTRATED BY THE EPA'S SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION (SITE) PROGRAM.
Environmental Protection Agency, Cincinnati, OH.
S. C. James.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 239-242. 2 fig.

Descriptors: *Activated carbon, *Cleanup operations, *Hazardous wastes, *Separation techniques, *Waste treatment, *Wastewater treatment, In situ treatment, Marine sediments, Organic carbon, Polychlorinated biphenyls, Soil contamination, Solvents.

Two hazardous waste cleanup technologies were demonstrated under the EPA's Superfund Innovative Technology Evaluation Program. The Terra Vac's in-situ vacuum extraction removes and vents volatile organic compounds (VOCs) from the unsaturated zone of soils. An extraction well is installed in the contaminated soil area and connected by piping to a vapor/liquid separator device. A vacuum pump draws the subsurface contaminants through the well, separator device, and activated carbon system before the airstream is discharged to the atmosphere. Subsurface vacuum and soil vapor levels are monitored by vadose zone monitoring wells. After an 8-week demonstration of the Terra Vac system, 1,300 lb of VOCs were extracted, a steady decline in the VOC recovery rate with time was noted, and reduced soil VOC concentration was demonstrated. The process can also remove VOCs from clay strata. The CF Systems (organic extraction utilizing solivents) utilize liquified gases as the extracting solvents to remove organics, such as hydrocarbons, oil, and grease from wastewaters or contaminated sludges or soils. The system was demonstrated on polychlorinate biphenyls (PCB)-contaminated sediments from the New Bedford, Massachusetts, harbor. A trailer-mounted organic extraction system for nonaqueous materials used a propane/butane mixture as the extraction solvent. Contaminated harbor sediments were fed into the top of the extractor. Condensed solvent flows upward through the extractor, making nonreactive contact with the waste. PCB removal efficiencies of 90% were achieved for sediments containing PCBs ranging from 350 to 2,575 ppm. A high removal efficiency was achieved after several passes of treated sediments through the unit. Extraction efficiencies >60% were achieved on the first pass of each test. Later passes of treated sediments through the unit resulted in efficiencies that ranged from zero to 84%. Metals were not removed from the sediments. (See also W91-06421) (Geiger-PTT)
W91-06437

CHARACTERIZATION OF FLOCS FOR SOLID/LIQUID SEPARATION PROCESSES.
Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
B. M. Moudgil, M. E. Springgate, and T. V.

Vasudevan.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 245-253. 3 fig, 2 tab, 11 ref. NSF-PYI Award MSM 8352125 and U.S. Geological Survey, Department of Interior Grant 14-08-0001-G1555.

Descriptors: *Flocculation, *Separation techniques, *Waste characteristics, *Waste treatment, *Wastewater treatment, Aggregates, Dolomite, Kaolinite, Mathematical models, Model studies, Particle size, Polymers, Shear stress.

Techniques were developed to characterize flocs with respect to size, density, and shear strength. Floc size was measured by transferring flocs from the large holding tray to glass slides and observing flocs under a microscope with a measuring grid. Floc density was determined by removing a single floc from the holding tray and placing it on a glass slide. The exterior water was removed and the floc was weighed using a precision analytical balance. The floc was dried for 4 hr at 50 C to remove the entrapped water. The volume fraction of solids and water in the flocs and thus the floc density was then determined using special mathematical equations. Two variations of the cluster-cluster aggregation model were used to study the fractal characteristics of flocs: the diffusion-limited and reaction-controlled aggregation variations. The strength of kaolinite, dolomite, and aluminum oxide flocs was evaluated with various polymers under turbulent flow conditions. Binding strength of flocs attained an optimum at a given polymer dosage. The optimum binding strength was independent of the molecular weight of the polymer. The dosage was determined to be 2.5 times lower for the higher molecular weight polyacrylamide. Binding strength of alumina with polyacrylamide at different pH values indicated that interparticle distance plays a major role in determining the strength of the aggregates formed. (See also W91-06421) (Geiger-PTT)
W91-06438

SURFACE CHARGE ON WASTEWATER SLUDGES.
Metcalf and Eddy, Inc., Wakefield, MA.
T. Bowen, and U. N. Tyagi.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 255-264. 6 fig, 1 tab, 9 ref.

Descriptors: *Anaerobic digestion, *Sludge, *Sludge conditioning, *Waste characteristics, *Wastewater treatment, Activated sludge process, Anions, Polymers, Sedimentation, Wastewater analysis.

Charged sites on the surface of three types of wastewater sludge were identified. Sludge samples were treated with cationized ferritin (CF) to label anionic charged sites on the surface of sludge particles. Sludge surfaces were examined using transmission electron microscopy. The presence of cationized ferritin granules indicated charged sites. Waste-activated, primary sedimentation, and anaerobic-digested sludge responded differently to CF staining. Each sludge had different attachment patterns and varied in the amount of CF attracted. Location of charge was associated with the presence of extracellular polysaccharide material. Waste-activated sludge attracted the most CF granules. Anaerobic-digested sludge was stained the least by CF. (See also W91-06421) (Author's abstract)
W91-06439

INVESTIGATION OF SOL PROTECTION IN CHEMICAL CLARIFICATION.
Ohio State Univ., Columbus. Water Resources Center.
A. J. Rubin, and P. R. Schroeder.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 266-287. 10 fig, 4 tab, 28 ref.

Descriptors: *Clarification, *Colloids, *Sedimentation, *Wastewater treatment, *Water treatment, Coagulation, Coal, Hydrogen ion concentration, Physicochemical properties, Settling velocity, Starch, Turbidity.

Organic species capable of being adsorbed by the particulates and enhancing their colloidal stability are often present in surface waters. This phenomenom is known as sol protection. Sol systems of oxidized and unoxidized colloidal coal, potato starch (amylose), and a mixture of the two that served as an example of a protected sol were examined during clarification. Sample turbidities during periods of quiescent settling were obtained as a function of either pH or coagulant concentration to obtain settling curves. The critical values obtained by extrapolation of the steep portions of the settling curves when plotted form a stability limit diagram that is characteristic of the sol-coagulant system. Turbidity and removal of starch sols were analyzed by spectrophotometry or light scattering measurements on a nephelometer. Turbidities of coal and coal-starch mixtures were estimated by spectrophotometry. The colloidal stability and electrophoretic mobility of the oxidized and unoxidized coal suspensions were examined as a function of pH. Oxidation lowered the isoelectric point four pH units by producing more easily ionized, acidic groups on the surface of the coal particles. Oxidation widened the pH range in which the coal sol was stable. The colloidal stability of a 1.0 g/L starch solution (in the absence of coal) was examined as a function of pH. The solution pH had little or no effect on the starch except for a slight reduction in the turbidity between pH 4.3 and pH 6.3. The critical pHs for the coal in the presence of 25 mg/L soluble potato starch was unchanged by starch, although the rate of clarification decreased markedly providing partial protection from aggregation. (See also W91-06421) (Geiger-PTT)
W91-06440

IMPORTANCE OF FLOCCULANT PREPARATION FOR USE IN SOLID/LIQUID SEPARATION.
Stranco, Inc., Bradley, IL.
Y. H. Kim.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 289-304. 9 fig, 1 tab, 21 ref.

Descriptors: *Flocculation, *Polymers, *Separation techniques, *Wastewater treatment, *Water treatment, Hardness, Hydrogen ion concentration, Mixing, Theoretical analysis, Viscosity, Water chemistry.

To achieve the optimum performance of water and wastewater treatment processes using polymeric flocculants, it is essential to manipulate the polymers adequately. Theoretical analyses have shown that polymer swelling in a solvent (activation) improves the possibility of particle interaction during flocculation. Polymer activation was determined by viscosity measurements on three acrylamide-based polymers with different ionicity (Praestol A3035L, anionic; Praestol K226FL, cationic; and Praestol N3100L, nonionic). Viscosity, as measured on a viscometer, decreased with increasing water hardness. The threshold of high viscosity of the polymer solutions occurred at about pH 3 for all polymers, regardless of their ionicities and of the hardness of the dilution water. Rheological behavior of the nonionic polymer was less sensitive to change in temperature than that of ionic polymers. A two-stage activation mechanism was proposed for the dissolution of emulsion polymer, and the two-stage mixing utilizing this mechanism was found to be very effective in polymer activation by reducing the aging time remarkably without damaging polymer structure. (See also W91-06421) (Geiger-PTT)
W91-06441

ADEQUACY OF ANALYTICAL TECHNIQUES TO DETERMINE THE FATE OF POLYELECTROLYTES IN WASTE TREATMENT.
Battelle Columbus Div., OH.
G. B. Wickramanayake, and B. W. Vigon.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 305-312. 2 fig, 35 ref.

Descriptors: *Chemical analysis, *Polyelectrolytes, *Waste analysis, *Wastewater analysis, *Wastewater treatment, Analytical methods, Assay, Chromatography, Pollutant identification, Quantitative analysis, Spectrophotometry.

Some of the polyelectrolytes used in wastewater treatment and industrial applications are toxic to aquatic life if released above certain concentrations. The advantages and disadvantages of available methods to determine the fate of polyelectrolytes during treatment processes were evaluated for 11 categories of analytical methods: nephelometry-turbidimetry, spectrofluorometry, spectrophotometry, interferometry, viscometry, colloid titration, luminescence titration, gel permeation chromatography, pyrolysis gas chromatography, bromine oxidation, and radioimmunoassay. Major limitations associated with most of these analytical methods include lack of specificity and sensitivity. To determine the distribution of polyelectrolytes in complex waste matrices at low concentrations, it may be necessary to develop a hybrid technique combining the advantages of several of the above techniques. Radiochemical methods (e.g., using C14-labeled polyelectrolytes and scintillation counting procedures) may be employed to validate and confirm such techniques before recommending them for routine analytical applications. (See also W91-06421) (Author's abstract)
W91-06442

ADSORPTION BEHAVIOR OF A HYDROPHOBIC POLYMERIC FLOCCULANT AND ITS RELATION TO FLOCCULATION AND FILTRATION DEWATERING OF COAL SLURRIES.
Ohio State Univ., Columbus. Dept. of Materials Science and Engineering.
Y. A. Attia, and S. Yu.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 313-324. 11 fig, 1 tab, 12 ref.

Descriptors: *Coal mine wastes, *Dewatering, *Filtration, *Flocculation, *Polymers, *Wastewater treatment, Adsorption, Hydrogen ion concentration, Minerals, Pyrite, Shales.

The adsorption behavior of a totally hydrophobic polymer, FR-7A, and its role in the flocculation and filtration of fine coal slurries was investigated. Adsorption of FR-7A on coal, pyrite, and shale minerals revealed that FR-7A had a higher adsorption affinity to coal and pyrite than to shale. FR-7A aided the flocculation of coal slurries and improved the moisture content, after removal by filtration, was reduced from 42.4 to 37%. An acidic slurry condition favored unselective adsorption of FR-7A on coal minerals, leading to improved total flocculation and filtration of fine coal slurries. Alkaline pH and the presence of sodium metaphosphate favored selective adsorption and flocculation of coal from associated minerals in the slurry. (See also W91-06421) (Author's abstract)
W91-06443

IN-SITU EXTRACTION OF CONTAMINANTS FROM HAZARDOUS WASTE SITES BY ELECTROOSMOSIS.
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5G.
W91-06444

RECENT DEVELOPMENTS IN SOLID/LIQUID SEPARATION INCLUDING ELECTROTECHNOLOGIES.
Battelle Columbus Div., OH.
H. S. Muralidhara.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 457-468. 6 fig, 6 tab, 17 ref.

Descriptors: *Acoustics, *Dewatering, *Electroosmosis, *Filtration, *Separation techniques, *Waste treatment, *Wastewater treatment, Industrial wastes, Ultrasonics.

Solid/liquid separation is an important operation practiced widely throughout the chemical, mineral, pulp and paper, biotechnology, food, and other industries. Electroosmosis and electrofiltration are two processes that use a dc electric field to enhance dewatering. In electroosmosis, the movement of water occurs through a porous membrane with the application of a dc electric potential. Electrofiltration involves predominantly the electrophoretic phenomena, i.e., movement of charged particles toward electrodes in the presence of a dc electric field. Magnetic fields (generally employing permanent magnets) have also been used in solid/liquid separation. Ultrasonic technology, when used in combination with other technologies, shows considerable promise as a dewatering technique. The electroacoustic dewatering (EAD) approach combines dc electrical and acoustic fields in the presence of vacuum or pressure to promote synergistic effects. The EAD process is currently near the commercialization stage of development. EAD scale-up has demonstrated a higher degree of dewatering and enhanced recovery of product when compared to other technologies. (See also W91-06421) (Geiger-PTT)
W91-06453

SOLID/LIQUID SEPARATION USING ALTERNATING CURRENT ELECTROCOAGULATION.
Electro-Pure Systems, Inc., Amherst, NY.
P. E. Ryan, T. F. Stanczyk, and B. K. Parekh.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 469-478. 2 fig, 3 tab, 19 ref.

Descriptors: *Coagulation, *Dewatering, *Electrochemistry, *Electrocoagulation, *Flocculation, *Separation techniques, *Waste treatment, *Wastewater treatment, Adsorption, Aluminum, Filtration, Metals, Oil, Organic wastes, Suspended solids.

The efficient removal of suspended solids, organics, metals, and soluble oils from aqueous solutions has recently been demonstrated using alternating current. The principles of electrostriction (charge neutralization) and electroflocculation (catalytic precipitation with aluminum) facilitate coagulation, rapid settling, oil separation, and improved dewatering without the use of expensive polyelectrolytes, chemical aids, or sophisticated mechanical filtration systems. The electrocoagulator has no moving parts, is small, and can usually be integrated with existing processes to facilitate source reduction and/or purification, while reducing the volume, as well as hazard potential, of the waste generated. It can also be used as a stand-alone unit process for end-of-pipe treatment or as a mobile on-site treatment step for remediation projects. Treatment of process wash waters is an excellent application. The coagulator has been operated in both continuous and batch flow modes in sizes ranging from 1 to 750 gal/min. Because of residual effectiveness and short contact times, often less than 50% of the solution requires treatment, thus minimizing pumping and space requirements. (See also W91-06421) (Author's abstract)
W91-06454

ELECTROCHEMICAL REACTOR SYSTEMS FOR METAL RECOVERY AND DETOXIFICATION OF INDUSTRIAL EFFLUENTS.
Toronto Univ. (Ontario). Dept. of Chemistry.
B. Fleet.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 479-496. 5 fig, 55 ref.

Descriptors: *Detoxification, *Electrochemistry, *Industrial wastewater, *Separation techniques, *Sludge treatment, *Wastewater treatment, Electrodes, Electrolysis, Metals.

Electrochemical reactors are electrolytic cells that perform a useful chemical process such as the recovery or detoxification of metals from industrial effluents. Three major applications of electrochemical reactors in metal recovery are electrowinning of metals from ores and primary sources, electrorefining of metals from aqueous solutions of molten salts, and electrolytic recovery of metals from waste sources and industrial effluents (electrochemical detoxification). Of the two-dimensional reactor systems, tank cells are the simplest for inorganic and inorganic processes. Other popular two-dimensional configurations are plate and frame cells, planar electrode cells and rotating cells. Three-dimensional reactors have increased space-time yields over the two-dimensional models. Recent designs in three-dimensional electrochemical reactors include the fluidized bed electrode, contiguous bed electrode, and packed bed cell. When conventional wastewater treatment technology coupled with land disposal of toxic wastes was compared to electrolytic techniques coupled with metal recovery at a printed board circuit industry in California, the electrolytic technology proved more economical in the long term in view of the rising cost of sludge disposal at waste dump sites. (See also W91-06421) (Geiger-PTT)
W91-06455

ULTRASONIC INTERACTIONS DURING SLUDGE DEWATERING.
Battelle Columbus Div., OH.
N. Senapati.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 497-502. 3 fig, 6 ref.

Descriptors: *Acoustics, *Dewatering, *Electrochemistry, *Separation techniques, *Ultrasonics, Shear, Sludge thickening, Theoretical analysis, Viscosity.

Electroacoustic dewatering (EAD) has been demonstrated to enhance the rate and degree of dewatering of a wide range of sludges. The additional solids weight percent due to the ultrasonic field in the presence of the electric and the pressure fields appears to be a strong function of the sludge material. Since most sludges are composed of very complex materials, it is difficult to characterize the sludge to identify a cause and effect relationship between the sludge and the potential effectiveness of the ultrasonic field to enhance dewatering during EAD processing. From the potential mechanisms of ultrasonic interaction with solid/liquid suspensions, a hypothesis was developed to correlate performance with the physical properties that can be measured. Preliminary study indicates that the imaginary part of the complex shear modulus and a dimensionless parameter termed a, that embodies both shear thinning property, the viscosity and the ultrasonic frequency, are two measurable physical parameters that can be correlated with EAD performance of a sludge. (See also W91-06421) (Geiger-PTT)
W91-06456

SCALE-UP OF ELECTROACOUSTIC DEWATERING OF SEWAGE SLUDGES.
Battelle Columbus Div., OH.
S. P. Chauhan, and H. W. Johnson.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 503-519. 12 fig, 5 tab, 9 ref.

Descriptors: *Acoustics, *Dewatering, *Electrochemistry, *Sludge thickening, *Sludge treatment, *Ultrasonics, *Wastewater treatment, Cost analysis, Electro-osmosis, Incineration, Separation techniques.

The electroacoustic dewatering (EAD) process is a patented process now under commercialization. The process utilizes electric and ultrasonic fields to obtain improved solid/liquid separation. The scale-up of the EAD process for belt pressing of sewage sludge was investigated. A number of sewage sludge samples were tested in a 7.6-cm diameter batch EAD system to determine the relevant parameters and the extent of additional dewatering possible with EAD. Extensive parametric studies were carried out on two sludges to design a 1.2-m belt width EAD postdewatering prototype unit. The prototype was tested with four mixed undigested sludges. The results showed general agreement with batch dewatering data and cost analysis confirmed the commercial viability of EAD for belt presses. The solids content of sludges dewatered with EAD could be raised economically to a level to allow self-sustained combustion in an incinerator. EAD processed sludge was also found economically attractive for composting. (See also W91-06421) (Author's abstract)
W91-06457

ELECTROMEMBRANE TECHNOLOGY: A NOVEL APPROACH FOR ANTIFOULING.
Battelle Columbus Div., OH.
H. S. Muralidhara, and S. V. Jagannadh.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 529-538. 4 fig, 3 tab, 25 ref.

Descriptors: *Electrochemistry, *Fouling, *Membrane processes, *Wastewater treatment, Comparison studies, Electrodes, Sludge thickening, Ultrafiltration.

An external electric field that utilizes electrokinetic and flow properties to enhance the efficiency of commercial membranes to prevent fouling was studied with a focus on minimizing the power consumption and electrode costs and utilizing existing membrane materials and module designs. The electromembrane (EMB) developed differed from other electric field approaches in the placement of the electrodes. The novel placement of electrodes is expected to maintain higher fluxes through the membrane for a lower energy input. The EMB technology was applied to acid whey, sewage sludge, and oil/water emulsions on a plate and frame unit using both micro-and ultrafiltration membranes of 60 sq cm membrane area. Preliminary comparisons with parallel runs without EMB showed that electromembranes performed 15 to 50% better than non-EMBs. The energy requirement using the EMB approach is small and ranges from 1 to 10 W/sq ft of membrane surface. The commercial use of EMB technology has also been demonstrated. (See also W91-06421) (Geiger-PTT)
W91-06458

WASTE MINIMIZATION AND RECYCLING WITH MEMBRANE FILTER PRESSES.
Du Pont de Nemours (E.I.) and Co., Newark, DE. Engineering Dept.
E. Mayer.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 539-547. 6 tab, 17 ref.

Descriptors: *Dewatering, *Filtration, *Membrane filters, *Membrane processes, *Sludge treatment, *Waste treatment, *Wastewater treatment, Case studies, Centrifugation, Recycling, Sludge disposal, Sludge thickening.

Recent Resource Conservation and Recovery Act regulations have placed severe restrictions on land disposal of waste sludges. A relatively new technique, membrane filter press dewatering, offers promise for reducing sludge volumes by enhancing dewatering operations. New filter presses have polypropylene recessed chamber and membrane plates and offer drier sludge cakes and lower disposal costs than conventional dewatering technologies. Many tests on an 8% solids sludge from a main plant waste treatment clarifier showed the superiority of membrane filter presses over other devices. The membrane was the least costly technology while producing cakes of 46% dewatering without polymer and 51% dewatering with polymer. The membrane press produced much clearer effluent and firmer, drier cakes with an acidic inorganic waste. The process rendered the washed cakes suitable for landfilling or recycle at less cost than centrifugation or vacuum filter technologies. The membrane plate press was the only technology of 16 schemes studied that decontaminated a heavy metal lagoon sludge and recovered the solids for metal recycling. The membrane filter press demonstrated better filtrate quality (without filter aid addition) than a centrifuge and a screw press to dewater a ceramic plant clarifier underflow sludge. The membrane filter press was also superior to other technologies at dewatering an organic waste sludge. The automated membrane

press has been successfully operated on the organic waste sludge for 6 months with only minor problems of vapor emission and plate failure which were correctable. (See also W91-06421) (Geiger-PTT)
W91-06459

MEMBRANE SEPARATION TECHNOLOGIES IN POLLUTION CONTROL: CASE HISTORIES.
Cartwright Consulting Co., St. Paul, MN.
P. S. Cartwright.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 549-559. 8 fig, 6 tab.

Descriptors: *Electrodialysis, *Membrane processes, *Reverse osmosis, *Ultrafiltration, *Wastewater treatment, Dewatering, Recycling, Separation techniques, Water pollution treatment.

The membrane separation technologies of microfiltration, ultrafiltration, reverse osmosis, and electrodialysis all possess characteristics that make them attractive for industrial pollution control applications. Microfiltration generally involves the removal of particulate or suspended materials ranging in size from 0.1 to 10.0 microns. Ultrafiltration is used to separate materials in the 0.001-0.1-micron range. Reverse osmosis typically separates materials less than 0.001 micron. Electrodialysis combines permeable membranes with an anode and cathode to effect separation. Several case histories detail applications of membrane separation technologies in pollution control applications. Electrodialysis reversal was used to concentrate the stream from a reverse osmosis system used to dewater an agricultural wastewater effluent. Feed flows of up to 33,000 gal/day were achieved with overall product water recovery as high as 90%. Reverse osmosis with a high-rejection cellulose acetate membrane was used to concentrate the highly organic waste stream of a hydraulic fluids manufacturing operation. The more concentrated wastes could be recycled or more easily removed. Tests are underway to combine this technology with activated carbon to absorb the chemical oxygen demand (COD) contaminants. Reverse osmosis was used to attain a zero discharge from an automotive catalytic converter production process that produces a slurry of aluminum, cerium and nickel. A spiral-wound membrane used on the worst case scenario produced a 95% recovery where only the acetate ion exceeded the discharge limit. By keeping the pH above 9 the acetate will exist primarily in ionic form and be more highly rejected. Pilot scale operation of this process resulted in higher suspended solids loadings in the effluent stream which caused membrane fouling, a problem that is being remedied by a cross-flow microfiltration pretreatment. Reverse osmosis was used to concentrate nitrate and nitrite contaminants in the wash stream of nitrogen tetroxide holding tanks of an aerospace manufacturer. After neutralization with sodium hydroxide, the waste stream undergoes a two-pass reverse osmosis treatment that renders about 95% of the waste stream reusable. (See also W91-06421) (Geiger-PTT)
W91-06460

EMERGING TECHNOLOGIES IN HAZARDOUS WASTE MANAGEMENT.
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 5G.
W91-06655

EMERGING TECHNOLOGIES FOR HAZARDOUS WASTE MANAGEMENT: AN OVERVIEW.
Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.
D. W. Tedder, and F. G. Pohland.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 1-9, 21 ref.

Descriptors: *Hazardous wastes, *Recycling, *Reviews, *Waste management, *Waste treatment, *Wastewater management, Bioaccumulation, Chemical properties, Detoxification, Microbial degradation, Residues, Soils, Technology.

Waste quantities have steadily increased due to population growth and because the specific waste generation rates continue to increase. Therefore, better technologies are needed to detoxify and isolate existing hazardous wastes from the environment. Selected technologies that are currently under development were examined. Two major topics were reviewed: (1) wastewater management technologies; and (2) soils, residues, and recycle techniques. It was found that anaerobic bacteria apparently have an important role to play in decreasing toxicity in soil systems through species degradation. These bacteria may also retard the migration of many organic and inorganic species through their maintenance of a chemically reducing environment. Microorganisms may also play important roles in water purification through their immobilization and the exploitation of their naturally occurring bioaccumulative properties. The ability to predict species degradation rates in wastewater appear to be limited for the near future. The chemistry of dilute wastewaters is usually complex and, while general trends can be predicted, meaningful quantitative analysis without experimentation is more elusive. Group contribution theory is probably one useful key, but considerably more work is needed and unexpected interactions between solutes, affecting their degradation rates in mixtures, are likely. Waste stabilization and degradation are both important, especially for existing wastes. Recycle, however, will doubtless become increasingly important, especially in the chemical industries and for the management of future wastes. In many instances, acceptable methods must be found for either reducing or eliminating hazardous waste production altogether. (See also W91-06655) (White-Reimer-PTT)
W91-06656

MECHANISTIC ASPECTS OF THE PHOTOCATALYTIC OXIDATION OF PHENOL IN AQUEOUS SOLUTIONS.
Delaware Univ., Newark. Dept. of Civil Engineering.
J. Tseng, and C. P. Huang.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 12-39, 16 fig, 2 tab, 46 ref.

Descriptors: *Hazardous wastes, *Phenols, *Photocatalytic oxidation, *Physicochemical treatment, *Toxic wastes, *Wastewater treatment, Chlorides, Hydrogen ion concentration, Oxygen, Temperature, Titanium dioxide, Ultraviolet radiation.

A photo-catalytic oxidation process using photocatalyst TiO2 and ultraviolet light to decompose phenol in aqueous solution was studied. The photocatalyst was thoroughly characterized for specific surface area (BET), surface charge (zeta potential), surface morphology (scanning electron microscopy, SEM) and surface composition (x-ray energy dispersion analysis, EDAX). Parameters such as oxygen, temperature, pH, concentration of photocatalyst, and phenol concentration that may affect the oxidation reaction were thoroughly examined. Results show that oxygen plays one of the most important roles in phenol photo-oxidation. Trace amounts of chloride can inhibit the phenol decomposition reaction while aluminum impurity enhances it. At high phenol concentrations, e.g. ca > 0.05 M, hydroquinone and a biphenyl dimer are the major intermediates of the oxidation reaction. Free radicals such as hydroxyl and super oxide are keys to photo-oxidation of phenol. Photocatalytic oxidation can be an effective process in degrading hazardous organic substances such as phenol. Toxic organics can be broken into an environmentally acceptable chemical such as CO2. TiO2 is an inexpensive semiconductor and should be affordable to many water and wastewater treatment utilities, and is stable upon photo-irradiation. (See also W91-06655) (Author's abstract)
W91-06657

FALLING-FILM AND GLASS-TUBE SOLAR PHOTOCATALYTIC REACTORS FOR TREATING CONTAMINATED WATER.
Sandia National Labs., Albuquerque, NM. Solar Thermal Collector Technology Div.
J. E. Pacheco, and J. T. Holmes.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 40-51, 8 fig, 16 ref. DOE contract DE-AC04-76DP00789.

Descriptors: *Photocatalytic reactors, *Photochemistry, *Solar radiation, *Ultraviolet radiation, *Wastewater reactors, *Wastewater treatment, Catalysts, Falling-film system, Glass tube trough system, Hydrogen peroxide, Performance evaluation, Reaction rates.

Photochemical destruction of a model compound was demonstrated with bench scale and with two engineering scale experiments. For the engineering scale experiments two solar concentrating hardware systems were used: a glass-tube/trough system and a falling-film/heliostat system. The ultraviolet (UV) power on the reactors of the bench scale, glass-tube/trough and falling film/heliostat systems were 0.15, 1600, and 5200 watts of UV. In the bench scale experiments, the use of hydrogen peroxide as an oxidant with a titanium dioxide catalyst under ultraviolet illumination yielded reaction rates significantly greater than without the oxidant. The thermal performances of both solar systems are favorable for photocatalytic processes, since destruction of the contaminant can take place before boiling occurs. The trough/glass tube system was evaluated in clear and partly cloudy weather, and the amount of time to attain the same level of destruction was proportional to the total incident solar energy. With the heliostat/falling-film system, experiments were performed at two power levels. The concentration of the model compound was reduced below detectable limits in less than 15 seconds of exposure. Preliminary data indicate initial reaction rates are linear with ultraviolet intensity, though further experimental studies need to be performed to verify this relationship. (See also W91-06655) (Author's abstract)
W91-06658

SUPPORTED CATALYSTS IN HAZARDOUS WASTE TREATMENT: DESTRUCTION OF INORGANIC POLLUTANTS IN WASTEWATER WITH HYDROGEN PEROXIDE.
FMC Corp., Princeton, NJ. Peroxygen Chemical Div.
R. A. Bull, and J. T. McManamon.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 52-66, 5 fig, 6 tab, 6 ref.

Descriptors: *Catalysts, *Hazardous wastes, *Hydrogen peroxide, *Inorganic compounds, *Oxidation, *Wastewater treatment, Costs, Cyanide, Hydrogen ion concentration, Metal catalysts, Sulfur, Sulfur compounds.

Inorganic pollutants in wastewater can be oxidatively destroyed with hydrogen peroxide using a supported metal catalyst system. Laboratory work has demonstrated the effectiveness of these heterogeneous catalysts in oxidizing reduced sulfur compounds (e.g., sulfide, thiosulfate) more rapidly and with better efficiency than conventional homogeneously catalyzed processes. These catalysts are also effective for oxidizing and detoxifying mercaptans and cyanide in wastewater. Metals and supports studied include transition metals on silica, alumina, and various natural and synthetic zeolites. The choice of metal and support varies with the pollutant. A significant advantage of heterogeneous catalysts is that they are not subject to pH limitations often found with soluble catalysts, working equally well in acid and alkaline conditions. Further, they can be used in treating continuously flowing wastewater streams without the need for continuous addition of metal salts. This eliminates the possibility of secondary pollution problems due to the added metal and reduces cost. (See also W91-06655) (Author's abstract)
W91-06659

DESTRUCTION OF MIXTURES OF POLLUTANTS BY UV-CATALYZED OXIDATION WITH HYDROGEN PEROXIDE.
Connecticut Univ., Storrs. Dept. of Chemical Engineering.
D. W. Sundstrom, B. A. Weir, and K. A. Redig.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 67-76, 10 fig, 10 ref.

Descriptors: *Catalysis, *Hazardous wastes, *Hydrogen peroxide, *Organic wastes, *Ultraviolet radiation, *Wastewater treatment, Benzene, Industrial wastes, Oxidation, Photochemical reactors, Trichloroethylene, Water supply.

Hazardous organic compounds present in many water supplies and industrial wastes must often be reduced to very low concentration levels. A study was conducted to investigate the destruction of mixtures of organic compounds by ultraviolet catalyzed oxidation with hydrogen peroxide as the oxidizing agent. All experiments were conducted in a batch photochemical reactor. The UV source was a low pressure mercury vapor lamp with an output of about 2 watts at the 254 nm resonance line. Hydrogen peroxide concentrations in the samples were determined by a glucose oxidase-peroxidase method. Benzene and trichloroethylene were used as the components because they are common priority pollutants and differ greatly in structure. The combination of ultraviolet light and hydrogen peroxide was effective in decomposing both components individually and in mixtures. The rate of reaction of trichloroethylene was much lower in a mixture with benzene than as a single component. The strong interaction between components demonstrates the need to study actual mixtures instead of attempting to predict mixture behavior from pure component data. (See also W91-06655) (Author's abstract)
W91-06660

UV DESTRUCTION OF PHENOLIC COMPOUNDS UNDER ALKALINE CONDITIONS.
FMC Corp., Princeton, NJ. Peroxygen Chemical Div.
H. M. Castrantas, and R. D. Gibilisco.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 77-99, 12 fig, 2 tab, 12 ref, append.

Descriptors: *Alkalinity, *Hazardous wastes, *Hydrogen peroxide, *Phenols, *Ultraviolet radiation, *Wastewater treatment, Acidity, Fentons reagent, Groundwater pollution, Hydrogen ion concentration, Oxidation.

Phenols and substituted phenols can be oxidatively destroyed using ultraviolet radiation and peroxide (UV-H2O2) over a range of conditions. Phenols were selected because: (1) phenols are commonly found as pollutants in wastewater and groundwater; and (2) many waters containing phenolics are alkaline. The effect of variables such as UV light intensity, phenol concentration, ratio of H2O2/phenol, pH and the effect of substituting phenols on reaction rates were determined. UV-H2O2 was found to be considerably more effective than UV alone. Significant reaction rates were seen at lamp outputs of 60,000 and 240,000 microW-sec/sq cm over a phenol concentration range of 10-1000 mg/L, a pH range of 4-10 and mole ratios of H2O2/phenol of 2.8/1 to 8.3/1. By being effective under alkaline as well as acid conditions, UV-H2O2 avoids the acid limitations of Fenton's reagent (Fe + H2O2) which is a well known method for destroying phenolic compounds. (See also W91-06655) (Author's abstract)
W91-06661

MODELING ADVANCED OXIDATION PROCESSES FOR WATER TREATMENT.
Illinois State Water Survey Div., Champaign. Aquatic Chemistry Section.
G. R. Peyton.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. 100-118, 8 fig, 22 ref.

Descriptors: *Model studies, *Organic pollutants, *Oxidation, *Peroxyl radicals, *Site remediation, *Wastewater treatment, Formaldehyde, Formic acid, Hydrogen peroxide, Methanol, Ozone, Superoxide.

Advanced Oxidation Processes (AOPs) are water treatment techniques which generate free-radicals in sufficient quantity that they are the primary active species responsible for the degradation of organic contaminants. Although water treatment units based on AOPs have been commercially available since the early seventies, the complex chemistry of such processes has only recently been well enough understood to allow modeling with any generality. A stoichiometric model for the AOPs such as ozone/UV, ozone/peroxide, etc., was developed, and is in the process of being verified for its utility for understanding the application of these processes. An eventual goal is the use of the model for prediction of optimum process configurations and parameters, ozone and UV dose requirements, by-products, etc. The model is based on the fact that organic radicals, created by hydroxyl radical attack on organic contaminants, react quickly with oxygen to form peroxyl radicals. These peroxyl radicals can either (1) eliminate superoxide to become stable by-products, or (2) undergo more complicated bimolecular decay to yield hydrogen peroxide and other by-products. The usefulness of the model has already been verified for the methanol/formaldehyde/formic acid system, where superoxide production predominates, and is currently being extended to molecules which do not produce superoxide directly from their peroxy radicals. (See also W91-06655) (Author's abstract)
W91-06662

DETERMINATION OF MONOD KINETICS OF TOXIC COMPOUNDS BY RESPIROMETRY FOR STRUCTURE-BIODEGRADABILITY RELATIONSHIPS.
Cincinnati Univ., OH. Dept. of Chemical Engineering.
S. Desai, R. Govind, and H. Tabak.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 142-156, 3 fig, 3 tab, 26 ref.

Descriptors: *Biodegradation, *Hazardous wastes, *Respirometry, *Toxic wastes, Activated sludge, Dyes, Kinetics, Oxygen requirements, Phenols, Phthalates.

Biodegradation is on of the most important mechanisms in controlling the concentration of chemical in an aquatic system because toxic pollutants can be mineralized and rendered harmless. Experiments using an electrolytic respirometer were conducted to collect oxygen consumption data for toxic compounds from the list of Resource Conservation and Recovery Act (RCRA) and RCRA land banned chemicals (phenols and phthalates). The estimation of Monod kinetic parameters were obtained for all the compounds by a graphical method. The first order kinetic constants for the substituted phenols were related to the structure of the compounds by the group contribution method. Based on the oxygen uptake data all the tested phenols and phthalates are biodegradable in activated sludge with the experimental conditions. Similar results have been noted in the literature. All compounds were degraded in excess of 80%. A methyl group in the o-, or p-, position of phenolic compounds decreases the degradation rate in comparison to phenol, while a m-methyl group does not affect the degradation rate. No such trend was observed with phthalates. With the exception of butyl benzyl phthalate, none of the test compounds inhibit aniline degradation. (See also W91-06655) (Author's abstract)
W91-06664

REMOVAL OF FLUORIDE ION FROM WASTEWATER BY A HYDROUS CERIUM OXIDE ADSORBENT.
Shin-Nihon Chemical Industry Co. Ltd., Tokyo (Japan).
J. Nomura, H. Imai, and T. Miyake.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 157-172, 10 fig, 3 tab, 9 ref.

Descriptors: *Adsorbents, *Adsorption, *Cerium, *Fluorides, *Industrial wastes, *Wastewater treatment, Calcium chloride, Freundlich isotherms, Hydrogen ion concentration, Polyolefinic resin, Regeneration, Sodium hydroxide.

Effluent fluorine has long been found in the wastewater of industrial facilities which use or process mineral resources, such as coal-fired power plants, aluminum smelteries, and phosphorus and fluorine manufacturing plants. A new adsorption process was developed and demonstrated to be practical for removal of fluoride ion from wastewater to a concentration of 1 mg/L or less. The adsorbent developed consists of polyolefinic resin beads carrying hydrous cerium oxide powder that has a large specific area. It has a high selectivity for the fluoride ion and exhibits an adsorption capacity of 8 to 25 mg-F/mL-adsorbent at fluorine concentrations of 0.2 to 20 mg/L, with adsorption conforming to the Freundlich isotherm, and is readily regenerated by alkalis for repeated, long-term use. The process consists of adjustment to a pH between 2 and 5, fluorine adsorption, adsorbent regeneration by NaOH and precipitation of CaF2 from used regenerant by addition of CaCl2. (See also W91-06655) (Author's abstract) (White-Reimer-PTT)
W91-06665

EVALUATION OF A CELL-BIOPOLYMER SORBENT FOR UPTAKE OF STRONTIUM FROM DILUTE SOLUTIONS.
Oak Ridge National Lab., TN. Chemical Technology Div.
J. S. Watson, C. D. Scott, and B. D. Faison.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. 5 fig, 3 tab, 9 ref. DOE De-AC05-84OR21400.

Descriptors: *Adsorbents, *Biological wastewater treatment, *Hazardous wastes, *Polymers, *Strontium, *Wastewater treatment, Biopolymers, Cations, Gel beads, Ion exchange, Microorganisms, Performance evaluation.

Metal ions are sorbed by a number of biological materials. In some cases, this phenomenon can be used to remove and concentrate ions from dilute waste solutions. Immobilization of Micrococcus luteus within beads of gelatin results in a material which is able to adsorb significant quantities of strontium from dilute aqueous solutions analogous to some nuclear industry wastewaters. The mechanism appears to be principally an ion-exchange phenomenon. Both the bone gelatin and the microbial cells contribute to strontium removal; the principal contribution from the cells appears to be sorption onto cell wall material. This particular biosorbent may not be an immediate replacement for conventional ion-exchange materials currently used to remove strontium from wastewaters. However, the findings do indicate that relatively inexpensive biological materials can be incorporated into particulate forms such as gel beads and used for the removal of dissolved metal ions from aqueous solutions. (See also W91-06655) (Author's abstract)
W91-06666

SELECTIVE REMOVAL OF METALS FROM WASTEWATER USING AFFINITY DIALYSIS.
Zhejiang Univ., Hangzhou (China). Dept. of Chemical Engineering.
S. Hu, R. Govind, and J. C. Davis.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 187-213, 9 fig, 2 tab, 15 ref.

Descriptors: *Dialysis, *Mathematical models, *Membranes, *Metals, *Toxic wastes,

*Wastewater treatment, Hydrogen ion concentration, Leachates, Macromolecules, Model studies, Numerical analysis, Simulation analysis.

One of the problems associated with wastewater treatment is the recovery of metals from ore leachates and removal of toxic metals from wastewater. The use of an Affinity Dialysis Process was studied in order to determine its applicability for removing metals from wastewater. The basic technique requires a solution of macromolecular agents in water which are capable of rapidly complexing metal ions. The macromolecular solution flows through the tube side of a hollow fiber membrane unit, with wastewater flowing through the shell side. The macromolecular solution can be regenerated by changing the pH of the solution. A mathematical model for the process was developed. The numerical method employed for solving the mathematical model was then checked using an analytical solution which showed good precision. Good agreement was found between the numerical model and experimental data. Extensive simulation studies showed the Affinity Dialysis Process exhibits much higher productivity and even better selectivity than the conventional dialysis process. (See also W91-06655) (Author's abstract)
W91-06667

NEW APPROACH FOR TREATMENT OF ACID-CONTAINING WASTE STREAMS.
Hebrew Univ. of Jerusalem (Israel). Casali Inst. of Applied Chemistry.
A. M. Eyal, A. M. Baniel, and J. Mizrahi.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 214-233, 10 fig, 1 tab, 21 ref.

Descriptors: *Acids, *Hazardous wastes, *Industrial wastes, *Metal-finishing wastes, *Separation techniques, *Wastewater treatment, Amines, Organic acids, Pickling liquors, Salts, Titanium dioxide, Zinc.

A new technology ('SEPROS') for treating acid-containing industrial waste streams was developed. The system is based on a novel family of extractants, composed of commercially available amines and organic acids. It provides for efficient, selective and reversible extraction of mineral acids and their salts. The extracted compounds are back-extracted by water, avoiding the consumption of auxiliary reagents such as neutralizing bases. The new technology provides for recovery of acids and of salts in pure and concentrated solutions and greatly facilitates further treatments required to dispose of effluents and/or recover other valuable components. The simplest cases of acid separation from effluents are those in which the acid-free solution can be discarded. The effluent is countercurrently extracted by an extractant, preferably one that is selective and is efficient also at low acid concentrations, in order to achieve nearly complete acid removal. The raffinate is discarded and the extract is treated for extractant regeneration in a second battery. Of immediate industrial and ecological interest are the treatment of waste streams from the titanium dioxide industry, the treatment of pickling liquors and the treatment of bleed streams from electrolytic zinc plants. The recovery of acids and salts reduces the treatment costs and decreases reagent losses. (See also W91-06655) (Author's abstract)
W91-06668

DECHLORINATION OF ORGANIC COMPOUNDS CONTAINED IN HAZARDOUS WASTES.
Wright State Univ., Dayton, OH. Dept. of Chemistry.
T. O. Tiernan, D. J. Wagel, G. F. VanNess, J. H. Garrett, and J. G. Solch.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 236-251, 6 tab, 6 ref.

Descriptors: *Dechlorination, *Hazardous wastes, *Organic compounds, *Separation techniques, *Waste treatment, Activated carbon, Benzofurans, Dioxins, Polyethylene glycol, Potassium hydroxide, Reagents, Waste disposal.

Chlorinated organic chemicals constitute a significant portion of the hazardous materials which are accumulating in the environment as the result of manufacturing processes and improper waste disposal practices. Laboratory and field tests have demonstrated that a chemical reagent prepared by reacting potassium hydroxide with polyethylene glycol (KPEG) effectively dechlorinates polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) which are contained in liquid hazardous wastes or which are sorbed on spent activated carbon. The effects of treatment duration, reaction temperature, the presence of water and volatile materials, and the quantity of the KPEG reagent on the efficiency of the KPEG dechlorination reaction with PCDD/PCDF in such waste materials was studied. The samples derived from the laboratory and field treatment tests were generally analyzed for tetra-, penta-, hexa-, hepta-, and octa-CDD/CDF, and the success of the dechlorination process was gaged by the extent to which the concentrations of these compounds were reduced in the treated samples as compared to the untreated samples. The results of the studies indicate that the concentrations of PCDD/PCDF in waste liquids can be reduced to levels of less than one part-per-billion by direct treatment with KPEG. In the case of the contaminated carbon matrix, however, direct KPEG treatment is somewhat less effective, and reduction of PCDD/PCDF to such concentrations appears to be best achieved by first extracting the carbon matrix with an appropriate solvent, and then treating the extract with KPEG. (See also W91-06655) (Author's abstract)
W91-06669

RECOVERY OF ORGANIC COMPOUNDS FROM SEWAGE SLUDGE BY PROTON TRANSFER.
Howard Univ., Washington, DC. School of Engineering.
M. S. Diallo, J. H. Johnson, R. Chawla, J. N. Cannon, and F. E. Senftle.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 311-327, 7 fig, 2 tab, 22 ref. DOE Contract DE-AC06-76RL1830.

Descriptors: *Energy sources, *Organic compounds, *Separation techniques, *Sludge treatment, *Sulfuric acid, *Waste recovery, Acid extraction, Aromatic organic compounds, Chemical recovery, Feasibility studies, Precipitation, Protonation.

The feasibility of a new process that recovers valuable organic materials from sewage sludge was examined. Sludge organic compounds, which have unshared electron pairs or which are unsaturated, protonate and dissolve in strong acid media such as concentrated sulfuric acid. These dissolved compounds can be precipitated and recovered unchanged from the concentrated acid solution by diluting the solution containing the dissolved organic compounds with water. Experimental results show that up to 75% of the solids in sludge can be dissolved during protonation and up to 25% of the initial solids can be precipitated upon dilution with water. The recovered product has a high organic content (90-98%) and represents approximately 30% of the organic compounds in the initial sludge. NMR spectroscopic analysis of an extract of the recovered product shows it to be primarily composed of aromatic organic compounds. These findings suggest that this new process has the potential to produce a high organic content product that could be used as a fuel or a source of organic chemicals. (See also W91-06655) (Author's abstract)
W91-06673

TREATMENT AND DISPOSAL OPTIONS FOR A HEAVY METALS WASTE CONTAINING SOLUBLE TECHNETIUM-99.
Oak Ridge Gaseous Diffusion Plant, TN.
W. D. Bostick, J. L. Shoemaker, P. E. Osborne, and B. Evans-Brown.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 345-367, 5 fig, 8 tab, 40 ref. DOE DE-AC05-OR21400.

Descriptors: *Hazardous wastes, *Heavy metals, *Radioactive wastes, *Waste disposal, *Waste utilization, *Wastewater treatment, Cements, Grout, Mercury, Nitrates, Pertechnetate, Sorption, Technetium, Toxic wastes, Uranium.

Various equipment decontamination and uranium recovery operations at the Portsmouth Gaseous Diffusion Plant generate a 'raffinate' waste stream characterized by toxic heavy metals, high concentrations of nitric acid, and low levels of radioactive nuclides (235U and 99Tc). Dilution and adjustment of solution pH to a value of 8.2 to 8.5 precipitates heavy metals that can be hydrolyzed. The precipitant is concentrated by paper filtration to yield a filter cake heavy metals sludge (HMS) and HMS filtrate. The HMS fraction may be incorporated into cement-based grout containing ground blast furnace slag to reduce the mobility of its toxic and radioactive components. Sorption of soluble mercury, pertechnetate, and nitrate anions from the HMS filtrate was tested using organic resins and inorganic sorbents. Removal of Hg and 99Tc by iron filings is efficient and economical, generating a small volume of spent sorbent amenable to co-disposal with HMS in a grout waste form, but the process is slow. For more rapid sorption, poly-4-vinylpyridine resin is very effective for the removal of soluble 99Tc with little uptake of interfering anions at near-neutral influent pH values. (See also W91-06655) (Author's abstract)
W91-06675

EXTRACTION OF PLUTONIUM FROM LEAN RESIDUES BY ROOM-TEMPERATURE FLUORIDE VOLATILITY.
Los Alamos National Lab., NM. Nuclear Materaisl Div.
G. M. Campbell, J. Foropoulos, R. C. Kennedy, B. A. Dye, and R. G. Behrns.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 368-377, 8 fig, 9 ref.

Descriptors: *Fluorides, *Hazardous wastes, *Plutonium, *Radioactive waste disposal, *Radioactive wastes, *Waste treatment, Aluminum, Fluidized bed reactor, Matrix reactor, Nickel, Stainless steel, Temperature effects, Volatility.

The use of dioxygen difluoride and krypton difluoride for the recovery of plutonium from lean residues by conversion to gaseous plutonium hexafluoride was investigated. The apparatus used in carrying out the gas-solid reactions involving the fluorination of plutonium residues was enclosed in a glove box designed for the safe handling of plutonium. Although nickel or aluminum were the preferred materials of construction for handling fluorinating agents, stainless steel was found to be perfectly adequate for many uses at room temperature. The processes used were a metal matrix reactor and a fluidized bed reactor. All the experiments were done in a batch mode. The dioxygen difluoride was maintained at liquid nitrogen temperature until introduction to the gas-solid reaction loop. The progress of the reaction was followed by monitoring pressures and by Fourier transform infrared spectroscopy. For the metal matrix reactor the chemical reaction efficiency of the oxygen fluorides (dioxygen difluoride and dioxygen nonofluoride) with plutonium tetrafluoride varied from about 12 percent at a loading of 82 g plutonium tetrafluoride, to 24% with a loading of 400 g. The fluidized bed reactor was the gas-solid reactor of choice for many chemical reactions in industry. The overall reaction efficiency was slightly higher (15% vs 12%) in the aluminum matrix reactor. A severe test of plutonium extraction was made by removing it as plutonium hexafluoride from incinerator ash. Fluorination of the ash at elevated temperature was shown to result in the formation of nonvolatile plutonium fluorides. When the un-

treated ash was fluorinated at room temperature, volatile plutonium hexafluoride was formed. Fluorination of plutonium compounds under ideal conditions supports the contention that a viable process can be developed. (See also W91-06655) (White-Reimer-PTT)
W91-06676

PEPTIDE SYNTHESIS WASTE REDUCTION AND RECLAMATION OF DICHLOROMETHANE.
Rockefeller Univ., New York.
R. V. Joao, I. Linins, and E. L. Gershey.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 379-387, 5 fig, 1 tab, 4 ref.

Descriptors: *Dichloromethane, *Hazardous wastes, *Peptides, *Waste disposal, *Waste recovery, *Waste treatment, Dimethylformamide, Distillation, Ethanol, Methanol, Purification, Trifluoroacetic acid, Waste reduction.

Reclamation and recycling of solid phase peptide synthesis effluents are important means of waste reduction. Peptide synthesis produces large amounts of chemical waste, the primary component of which is methylene chloride (dichloromethane, DCM). Other significant components are ethanol, methanol, dimethylformamide, trifluoroacetic acid. Due to the high halogen content of the mixture, disposing of this is costly. Reclaiming DCM has reduced the volume of chemicals shipped as waste by 25% at some institutions. Separating and purifying DCM is a four part process involving distillation, aqueous extraction, sieving, and analysis. Recovery of the distillate between 37 and 40.5 C results in an azeotropic mixture which is approximately 95% DCM, 5% methanol, and trace amounts of other components. Most of the methanol is removed by two 1:1 water washes. The remaining trace amounts of methanol and water are removed by 4 angstrom molecular sieves. High sensitivity capillary gas chromatography and flame ionization detection indicate that the product is greater than 99.9% pure. (See also W91-06655) (Author's abstract)
W91-06677

SOLVENT WASTE REDUCTION.
Environmental Protection Agency, Cincinnati, OH. Environmental Criteria and Assessment Office.
Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. 158p. appends.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Industrial wastes, *Solvents, *Waste disposal, *Waste treatment, Biological treatment, Chemical treatment, Incineration, Off-site waste disposal, On-site waste disposal, Recycling, Waste reduction.

Papers presented at U.S. EPA seminars covering various aspects of solvent waste reduction, from regulations and disposal bans to on-site and off-site treatment methods are contained in this book. The Appendices give additional details on separation techniques, treatment and pretreatment methods, and good operating practices. Waste reduction can be defined as: (1) any in-plant practice or process that avoids, eliminates, or reduces waste so as to reduce environmental risk to any media, and/or (2) the treatment, reuse, or recycling of any material that reduces the volume and/or toxicity of waste prior to final disposition. Almost all industrial plants use solvents, usually for cleaning, degreasing, painting, paint stripping, or extraction purposes. Therefore, proper management of solvent wastes is of widespread concern. There are several disposal methods available to solvent users, but in many cases the most environmentally sound and economical choice is not to dispose of the solvent at all, but to recycle it. A brief review of the generally accepted priority list of hazardous waste management techniques indicates it is incumbent upon generators of waste, first to institute a program to reduce the amount of waste generated. Second, after the amount of waste generated has been minimized, recycling is considered the next most appropriate alternative. Third on most lists is incineration, and fourth is chemical or biological treatment to render the waste nonhazardous. Landfills, deep-well injection, and other methods fall further down the list. (See W91-06679 thru W91-06690) (White-Reimer-PTT)
W91-06678

MINIMIZATION OF PROCESS EQUIPMENT CLEANING WASTE.
Jacobs Engineering Group, Inc., Pasadena, CA. HTM Div.
For primary bibliographic entry see Field 5G.
W91-06681

SOLVENT WASTE MINIMIZATION BY THE COATINGS INDUSTRY.
PPG Industries, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 5E.
W91-06683

WASTE REDUCTION FOR CHLORINATED SOLVENTS USERS.
Dow Chemical U.S.A., Midland, MI.
E. R. Randolph.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 66-77, 4 fig, 1 tab, appends.

Descriptors: *Chemical wastes, *Chlorinated hydrocarbons, *Hazardous wastes, *Solvents, *Waste reduction, *Waste treatment, Costs, Industrial cleaning, Waste disposal, Waste management.

Internal and external efforts to reduce waste from the use of specialty chlorinated solvents, factors influencing solvent consumption, and issues in solvent waste disposal are described to illustrate some principles of waste management. Specialty chlorinated solvents include 1,1,1-trichloroethane, trichloroethylene, methylene chloride, and perchloroethylene. The diverse applications for these products include metal cleaning, dry cleaning, chemical processing, and production of fluorocarbons, aerosols, paint removers, adhesives, coatings/inks, and blowing agents. Conservation and efforts to encourage more efficient use of solvents have contributed to both the decline in demand for all virgin chlorinated solvents and the decline in use of virgin chlorinated solvents for metal cleaning applications. The use of in-house stills to recover solvent and concentrate waste typically results in up to a 20 percent reduction in solvent use. Most of the techniques for reducing waste during cold cleaning and vapor degreasing are easy to follow and improve the efficiency with which the operations use solvents. Reducing waste from the use of chlorinated solvents for metal cleaning means lower solvent costs and lower waste-disposal costs. The improved efficiency that helps reduce waste also means improved cleaning with no increase in solvent usage. (See also W91-06678) (White-Reimer-PTT)
W91-06685

ON-SITE REUSE AND RECYCLE OF SOLVENTS.
Salvesen (Robert H.) Associates, Red Bank, NJ.
R. H. Salvesen.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 78-89, 1 fig, 7 tab.

Descriptors: *Hazardous materials, *Hazardous wastes, *Recycling, *Solvents, *Waste disposal, *Waste recovery, Cleaning materials, Hazardous waste treatment, On-site wastewater treatment, Regulations, Waste management, Waste treatment.

Practices and equipment which are appropriate for cleaners of parts and equipment are reviewed. The major types of solvents utilized are hydrocarbon (such as mineral spirits and naphthas) and oxygenated materials. By proper segregation, labeling and management, essentially all solvents can be recycled. In most cases, the solvents are not consumed, but are contaminated by other substances. The solvents are disposed of when the contaminant level exceeds certain limits. Consideration of options for reuse and recycling of solvents should include segregation practices, substitutes and downgrading, equipment requirements, costs, and environmental regulations. In almost all cases where solvents are recycled, some residues remain which have to be disposed as hazardous wastes. Options include land filling, incineration, encapsulation, blending with asphalt, and others. The major concerns for the in-plant recycle and reuse of solvents are: (1) quality and quantity of used solvents; (2) segregation and handling practices; (3) selection of recycling equipment; (4) management practices; and (5) costs for operation and maintenance. (See also W91-06678) (White-Reimer-PTT)
W91-06686

COMMERCIAL (OFF-SITE) SOLVENT RECLAMATION.
Solvent Resource Recovery, Inc., West Carrolton, OH.
B. R. Dawson.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 90-96.

Descriptors: *Hazardous materials, *Hazardous wastes, *Recycling, *Solvents, *Waste recovery, *Waste treatment, Economic aspects, Environmental protection, Industrial wastes, Quality control, Waste disposal, Waste reduction.

Solvents are an important part of most industrial operations. Almost all plants use solvents, usually for cleaning, degreasing, painting, paint stripping, or extraction purposes. There are several disposal methods available to solvent users, but in many cases the most environmentally sound and economical choice is not to dispose of the solvent at all, but to recycle it. Two basic types of off-site or commercial solvent recycling are available; custom toll recycling and open market recycling. In custom toll recycling, the generator's spent solvents are kept segregated, batch processed separately to the generator's specification, and then returned for reuse. In open market recycling the spent solvents are co-mingled with like or similar wastes from many generators, and processed to specification for resale and reuse in the marketplace as refined solvent. The prevailing method of processing solvents is distillation or vaporization. If the recycler carefully follows all the quality control steps, industries are assured of receiving a quality product, appropriate for almost any use. Recycling can be shown to be an economical alternative to disposal. (See also W91-06678) (White-Reimer-PTT)
W91-06687

MAKING THE MOST OF BOTTOMS AND RESIDUALS.
Dames and Moore, San Francisco, CA.
S. F. Miller.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 97-100, 3 fig.

Descriptors: *Hazardous materials, *Hazardous waste disposal, *Recycling, *Waste disposal, *Waste treatment, Bottoms, Landfills, Polymers, Quality control, Residues, Solvents, Waste reduction.

Historically, most oil rerefining and solvent recovery processes have focused on recovery of supernatants and distillates and consigned the bottoms and residuals to disposal. That approach often left the most valuable molecules in the discarded fraction which typically went to the landfill. The evolution of a company which began as a lube oil marketer, decided to use waste oil as raw material, and thus became a waste generator, is presented. The company undertook an ambitious waste minimization program through use of bottoms and residuals, expanded to Resource Conservation and Recovery Act (RCRA) licensing, and thus was able to expand its oil and solvent utilization. Through a series of process changes including polymer addition, and oil distillation it was possi-

ble to reduce the waste products to nonhazardous materials that could be landfilled. The company was always careful in selecting suitable wastes as feedstocks. Bench and pilot tests were employed to check compatibility of residuals with the bottoms product, to maintain bottoms product quality, and to avoid coking/decomposition in process units. Unsuitable waste streams were always rejected. (See also W91-06678) (White-Reimer-PTT)
W91-06688

TREATMENT: SOLVENT WASTESTREAMS.
Salvesen (Robert H.) Associates, Red Bank, NJ.
R. H. Salvesen.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 101-104.

Descriptors: *Chemical wastes, *Hazardous materials, *Hazardous waste treatment, *Solvents, *Waste disposal, *Waste treatment, Biodegradation, Incineration, Oxidation, Recycling, Waste containment, Waste reduction.

Treatment of used solvents is an option often selected as a means of waste minimization or source reduction. While the preferred treatment is recycling for the original use, other technologies are available which enable solvents to be used for other purposes. Commercially available treatment technologies include downgrading/waste exchange, cement kilns, asphalt kilns, stripping, incineration, biodegradation, oxidation, and encapsulation. Used solvents from most industrial operations can be treated for recycle, reuse, or disposal. Recycle normally involves practices such as segregation and redistillation to produce solvents meeting new product specifications. Other treatment methods such as blending for fuels, stripping, incineration, biodegradation, oxidation, and encapsulation are viable options for handling various types of used solvent. Commercial experience has proven the benefits of these treatment technologies. (See also W91-06678) (White-Reimer-PTT)
W91-06689

TREATMENT OF SPENT SOLVENT WASTEWATERS: FOCUS ON CHANGING ECONOMICS.
Versar, Inc., Springfield, VA.
D. Pepson.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 105-108, 1 tab.

Descriptors: *Chemical wastes, *Economic aspects, *Hazardous waste treatment, *Solvents, *Waste treatment, *Wastewater treatment, Biological treatment, Carbon adsorption, Land disposal, Monitoring, Regulations, Stripping.

Treatment technologies that are commonly used to treat spent solvent wastewaters are stream stripping, carbon adsorption, and biological treatment. One area of treatment design that has not been examined to any great extent is whether past cost optimization studies are still valid in view of changes in treatment requirements associated with the land disposal regulations and other regulations under the Hazardous and Solid Waste Amendments of 1984. An examination of the economics of the wastewater treatment technologies now being used was performed. One important aspect of these recent regulations may well be that past practices of including polishing or back-up systems as part of treatment trains is no longer cost effective. Under today's requirements, facilities may find improved control systems to be a better alternative. One possibility is continuous monitoring of the wastewater stream and automatic diversion to holding tanks when the waste does not comply with regulatory requirements. (See also W91-06678) (White-Reimer-PTT)
W91-06690

LAND APPLICATIONS: ITS EFFECTIVENESS IN PURIFICATION OF URBAN AND INDUSTRIAL WASTEWATERS IN LA MANCHA, SPAIN.
Universidad de Alcala de Henares, Madrid (Spain). Dept. of Geology.
I. de Bustamante.
Environmental Geology and Water Sciences EGWSEI, Vol. 16, No. 3, p 179-185, November/December 1990. 5 fig, 13 ref.

Descriptors: *Industrial wastewater, *Land disposal, *Land treatment, *Spain, *Wastewater disposal, *Wastewater irrigation, *Wastewater pollution, *Wastewater treatment, Ammonia, Chemical oxygen demand, Conductivity, Effluents, Industrial wastes, Lysimeters, Municipal wastewater, Nitrogen, Phosphorus, Potassium, Sodium, Soil filters, Subsoil, Total organic carbon, Trees, Wastewater analysis, Wastewater composition.

In the region of La Mancha it has been the custom to dispose of both urban and industrial effluents by introducing them into the subsoil. However, the growth of population areas and industrial development has resulted in a considerable increase in the amount of effluents and has limited disposal to restricted areas. The current study evaluates the effectiveness of the treatment of wastewater by land application and compares the results of discharging urban and industrial effluents to the River Guadiana basin. Land applications are plots whose dimensions are in direct relation to the effluent flow, where groups of black poplars are planted in ridges and irrigated by flooding. The philosophy followed to determine the purifying capacity of land application on wastewater, was to trace the contaminants at depth. For this, samples were taken of the waste and from the lysimeters that were in use. The results of the analysis indicated that all the contaminants analyzed in the discharged wastewater in both land application undergo considerable reduction as they passed through the soil. The soil acted as a filter, eliminating organic compounds, nutrients, and microorganisms. With regards to sodium and potassium cations, the soil acted in a different way than might be expected by releasing potassium and fixing sodium in the first few centimeters of soil. This occurred, apparently, because irrigation with wastewater modified the chemical conditions. (Korn-PTT)
W91-06799

LOCATING LAGOON SEEPAGE WITH RADAR AND ELECTROMAGNETIC SURVEY.
Clemson Univ., SC. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W91-06801

FATE AND PERSISTENCE OF BACILLUS SPHAERICUS USED AS A MOSQUITO LARVICIDE IN DAIRY WASTEWATER LAGOONS.
California Univ., Riverside. Dept. of Entomology.
B. A. Matanmi, B. A. Federici, and M. S. Mulla.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 3, p 384-389, September 1990. 4 fig, 1 tab, 18 ref.

Descriptors: *Bacillus, *Barn wastewater, *Insect control, *Larvicides, *Mosquitoes, *Pesticides, *Wastewater lagoons, Animal wastes, Bottom water, Dairy industry, Farm lagoons, Lagoons, Microbial studies, Mud, Spores, Surface water.

The fate and persistence of the mosquitocidal bacterium, Bacillus Sphaericus, in dairy wastewater lagoons was evaluated in conjunction with trials of its larvicidal efficacy against Culex stigmatosoma. Two commercial formulations, BSP-2 (at 4.48 kg/ha) and ABG-6184 at 2.24 kg/ha) gave about 90% reduction for up to 4 weeks, although surface water lost its insecticidal activity by 3 days post-treatment. Spores settled to the bottom within 3 days of treatment, but could be recovered in surface water after reflooding. Spore concentrations in bottom water varied widely, yet insecticidal activity remained high for from 3 days (BSP-2 at 4.48 kg/ha) to 2 weeks (ABG-6184 at 2.24 kg/ha). Spores persisted in the mud throughout the study period. These results indicate the the extended control obtained was due primarily to the ingestion of spores from bottom water and mud by larvae, which routinely inhabit the shallow areas toward the edge of the pond and browse at the pond bottom. (Author's abstract)
W91-06823

EVALUATION OF BACILLUS SPHAERICUS 2362 AGAINST CULEX QUINQUEFASCIATUS IN SEPTIC DITCHES.
Arkansas Univ., Fayetteville. Dept. of Entomology.
J. W. Jones, A. A. Weatherbee, P. Efird, and M. V. Meisch.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 3, p 496-499, September 1990. 2 tab, 9 ref.

Descriptors: *Bacillus, *Domestic wastes, *Insect control, *Larvicides, *Mosquitoes, *Wastewater treatment, Animal wastes, Barn wastewater, Dairy industry, Population density.

Four application rates of Bacillus Sphaericus 2362 were tested for efficiency in septic ditches against Culex quinquefasciatus 2nd-4th instar larvae. Trials were conducted over a 2 year period. In 1987, all dosages applied to dairy effluent ditches resulted in substantial reductions after 48 h. Differences among dosages did not differ significantly ($P >$ or equal to 0.05). After 5 days, mosquito larval numbers increased with dosage rates of 0.6, 0.9, and 1.2 liters/ha. Residual control was maintained, however, at 2.4 liters/ha for 17 days. In 1988, B. sphaericus applied to domestic sewage effluent ditches at a rate of and 2.4 liter/ha induced $>$ 79% suppression for a period of 15 days, and the 1.2 liter/ha rate induced $>$ 79% suppression for a period of 20 days. A rate of 0.9 liter/ha provided good to excellent control ($>$ 85%) for a period of 10 days. A rate of 0.6 liters/ha produced $<$50% suppression after 48 h. A reduction in larval densities was observed at all treatment rates. The conditions that seem to reduce activity of the microbial agent include water movement, sunlight, and high concentrations of suspended solids. (Doyle-PTT)
W91-06825

EVALUATION OF ULTRAVIOLET (UV)-OXIDATION TREATMENT METHODS.
Geraghty and Miller, Inc., Tampa, FL.
E. K. Nyer, and P. Bitter.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 88-92, Winter 1991. 4 fig, 3 tab, 3 ref.

Descriptors: *Decontamination, *Evaluation, *Hydrogen peroxide, *Oxidation, *Ozonation, *Ultraviolet radiation, *Wastewater treatment, *Water pollution treatment, Estimated costs, Groundwater pollution, Iron, Pretreatment of water, Superfund.

Ultraviolet-oxidation or UV-oxidation is emerging as a viable treatment technology that promises to destroy many organic compounds in a short time and at a reasonable cost. EPA's Superfund Innovative Technologies Evaluation (SITE) program has evaluated this technique and published positive results. This has led to major marketing campaigns to promote UV-oxidation to regulators, industries, and consultants in the field of groundwater treatment. The two basic ways in which UV-oxidation is applied. They are UV-ozone and UV-peroxide. While ozone and hydrogen peroxide are both strong oxidants, their effectiveness increases dramatically when stimulated by UV light. The principle objection to the SITE demonstration trials of this technology is that the bench scale trial runs were of a mere 4 hr duration. The data extrapolated from these tests cannot guarantee sustained reactor performance over extended periods of time. When data from a full scale UV-peroxide reactor designed for 15-20 gpm, 200 ppm of H202, and 180 kW UV power, are examined, the true performance and costs of this technology can be evaluated. The average concentration of benzene, for example, after UV treatment was 8500 times greater than the concentration resulting from the bench scale study. The problem was apparently caused by dissolved iron precipitating out and covering the quartz tubes containing the UV lamps. This necessitated adding a pretreatment system to remove dissolved iron, but problems continued when biological floc coated the tubes. Cleaning the quartz tubes was performed twice a month and

required the UV unit to be shut down for eight hours each time. A cost comparison between the initial estimate and actual costs reflected a 24% increase in cost for additional and unanticipated modifications. (Doyle-PTT)
W91-06847

EVALUATING THE EFFECTIVENESS OF GROUND WATER EXTRACTION SYSTEMS.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
For primary bibliographic entry see Field 5G.
W91-06852

SAND AND ACTIVATED CARBON AS BIOFILM CARRIERS FOR MICROBIAL DEGRADATION OF PHENOLS AND NITROGEN-CONTAINING AROMATIC COMPOUNDS.
Gesamthochschule Paderborn (Germany, F.R.). Fachbereich 13 - Chemie und Chemietechnik.
B. Koch, M. Ostermann, H. Hoke, and D. C. Hempel.
Water Research WATRAG, Vol. 25, No. 1, p 1-8, January, 1991. 7 fig, 3 tab, 28 ref. Ministerium fur Umwelt, Raumordung und Landwirtscraft des Landes Nordrhein-Westfalen, Germany.

Descriptors: *Activated carbon, *Biofilms, *Biological wastewater treatment, *Microbial degradation, *Wastewater treatment, Aerobic treatment, Aromatic compounds, Biodegradation, Dissolved organic carbon, Organic pollutants, Performance evaluation, Phenols, Sand.

The aerobic biodegradation of a mixture of 22 phenols, N-hetrocycles and aromatic amines in a model wastewater containing these components as sole source carbon was measured by isolating a mixed culture from soil, which was adapted to continuous flow conditions and immobilized in fluidized particles of sand or activated carbon. During long-term experiments in an airlift-loop reactor, dissolved organic carbon concentrations (DOC) of the medium were varied between 125 and 1000 mg/L and the dilution rate between 0.25 and 0.78/h . DOC removal in the sand system was constant with values fluctuating between 59 and 69 %. Biomass concentration first increased in proportion to the volumetric DOC loading rate, but reached a plateau at loading rates above 200 mg/L/hr with values fluctuating around 4.4 g/L. With activated carbon the biomass concentration was higher under the same conditions, but DOC removal decreased during operation down to a final value of 39%. It was assumed that biodegradation is superimposed by adsorption of organic matter up to the saturation of the carbon. Only a minor part of the biomass was immobilized on the coal particles, while the major part was aggregated as flocs and pellets. The low metabolic activity of the activated carbon system is ascribed to inhibitory effects of by-products. Gas chromatographic analysis of individual components revealed that the feed components were nearly completely degraded in both systems, but evidence was found for the formation of dead-end products. (Author's abstract)
W91-06857

PERIPLASMIC AND INTRACYTOPLASMIC POLYPHOSPHATE AND EASILY WASHABLE PHOSPHATE IN PURE CULTURES OF SEWAGE BACTERIA.
Freiburg Univ. (Germany, F.R.). Inst. fuer Biologie 2.
M. Streichan, and G. Schoen.
Water Research WATRAG, Vol. 25, No. 1, p 9-13, January, 1991. 6 fig, 22 ref. Bundesministerium fur Forschung und Technologie, Germany, No. 02 WA 8512 and 02 WA 8807.

Descriptors: *Activated sludge, *Biological wastewater treatment, *Microbial degradation, *Phosphorus removal, *Wastewater treatment, Acinetobacter, Biodegradation, Phosphates, Pure cultures.

In order to obtain further information about the fixation of phosphorus in the biomass of an activated sludge system, several strains of Acinetobacter and one strain of Moraxella, all isolated from activated sludge obtained from sewage plants with biological phosphorus removal, were examined to determine whether polyphosphate can be incorporated in different cell compartments and to what degree additional absorption at the surface of the cell takes place. It was determined that polyphosphate-accumulating bacteria of activated sludge from sewage plants can remove and store phosphorus from wastewater in different, specific ways: Acinetobacter strains with enhanced phosphorus accumulation stored polyphosphate inside the cell as cytoplasmic inclusions. Moraxella (strain St-8) stored polyphosphate intracytoplasmically, as well as in the periplasm. In addition, this strain could fix phosphate on the cell surface in high concentrations already at pH values below pH 8.0. This phosphate could be washed off by Tris-HCl buffer. From these results, it can be concluded that in sewage plants phosphorus is also fixed in different ways in or on the biomass during the biological removal of excess phosphorus in the activated sludge process. (Author's abstract)
W91-06858

ROLE OF SUBSTRATE CONCENTRATION IN PARTICLE SIZE DISTRIBUTION OF METHANOGENIC SLUDGE IN UASB REACTORS.
Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
J. T. Grotenhuis, J. C. Kissel, C. M. Plugge, A. J. Stams, and A. J. Zehnder.
Water Research WATRAG, Vol. 25, No. 1, p 21-27, January, 1991. 3 fig, 5 tab, 23 ref. NATO Research Grant No. 064/86.

Descriptors: *Anaerobic digestion, *Biological wastewater treatment, *Methanogenesis, *Wastewater treatment, Flow velocity, Growth kinetics, Particle size, Sludge analysis, Sludge bed, Substrates.

The effect of influent substrate concentration on particle size distribution of methanogenic granular sludge was studied in laboratory-scale UASB (upflow anaerobic sludge blanket) reactors fed with propionate as the sole carbon and energy source. A mean biomass increase of 60.9 mg volatile suspended solids (VSS/d) and 0.95 ml sludge/d was measured in five UASB reactors operated in parallel mode, resulting in a mean sludge volume index (SVI) of 7.8 ml sludge/g dry wt. Particle size distributions were measured by a gravimetric method and by direct image analysis. Median granule diameter increased with increasing influent substrate concentration and decreased with decreasing concentration. Increasing the influent concentration led to an increase of the methanogenic activity of the granules with propionate or acetate as test substrate. (Author's abstract)
W91-06860

OXYGEN TRANSFER IN TRICKLING FILTERS.
Fondation Univ. Luxembourgeoise, Arlon (Belgium).
J. L. Vasel, and P. Schrobiltgen.
Water Research WATRAG, Vol. 25, No. 1, p 53-60, January, 1991. 2 fig, 6 tab, 27 ref.

Descriptors: *Oxygen transfer, *Trickling filters, *Wastewater treatment, Biofiltration, Biological filters, Biomass, Hydrodynamics, Mass transfer, Model studies, Oxygen balance, Respiration.

Oxygen transfer in trickling filters, using a clean, random plastic media covered with biomass, is correlated with hydrodynamics. Different equations for oxygen transfer are proposed for plug flow or axial dispersion hydraulic models. These equations are solved by successive iterations to find the oxygen transfer coefficient and finally the oxygen transfer performance expressed in kg O2/kWh. Another way to quantify gas transfer in the presence of biochemical reaction is to utilize a tracer gas. Experimentally, propane gas, on clean media results in an oxygen transfer performance of 2 kg O2/kWh. The results are similar for the plug flow model and for the axial dispersion model. When biomass respiration is endogenous, the oxygen balance on the tower results in a much greater oxygen transfer performance, the minimum calculated is 22 kg O2/kWh. In this case, oxygen transfer is amplified by a factor of approximately 10, due to biomass respiration. The fact that the liquid at the outlet of the tower is generally saturated with oxygen seems to contradict experimental measurements. This state of saturation should be incompatible with an enhancement factor for oxygen transfer greater than 1. This may be due to a two layer liquid film phenomenon in which the upper moving layer is free, saturated with oxygen, and well explained by hydrodynamics, and the other is almost stagnant, oxygen poor, and may be responsible for mass transfer limitation in trickling filter processes. (Doyle-PTT)
W91-06864

HYDROLYSIS OF PARTICULATE SUBSTRATE BY ACTIVATED SLUDGE UNDER AEROBIC, ANOXIC AND ANAEROBIC CONDITIONS.
Technical Univ. of Denmark, Lyngby. Dept. of Environmental Engineering.
M. Henze, and C. Mladenovski.
Water Research WATRAG, Vol. 25, No. 1, p 61-64, January, 1991. 5 fig, 3 tab, 9 ref.

Descriptors: *Activated sludge, *Hydrolysis, *Nitrogen compounds, *Wastewater treatment, Aerobic conditions, Ammonia, Anaerobic conditions, Anoxic conditions, Biomass, Culturing techniques, Organic matter, Substrates.

Raw municipal wastewater, used as a substrate, was mixed with activated sludge from a high loaded activated sludge plant with pure oxygen aeration. Hydrolysis of particulate organic substrate was followed through the production of ammonia. The mixture of raw wastewater and activated sludge was transferred into three 1 liter flasks, each of which represented three electron acceptor conditions: aerobic (aerated by diffuse air), anoxic (280 mg NO3-N added as KNO3), and anaerobic conditions. The experimental period was restricted to four days to ensure an approximately constant biomass. The hydrolysis rate of nitrogenous compounds is significantly affected by the electron donor available. The rate is high under aerobic conditions, medium under anaerobic conditions and low under anoxic conditions. The ratio between the hydrolysis rates under aerobic and under anoxic conditions are very similar to the respiration rates measured as electron equivalents. (Doyle-PTT)
W91-06865

EFFECT OF CHROMIUM (VI) ON ACTIVATED SLUDGE.
Middle East Technical Univ., Ankara (Turkey). Dept. of Environmental Engineering.
C. F. Gokcay, and U. Yetis.
Water Research WATRAG, Vol. 25, No. 1, p 65-73, January, 1991. 10 fig, 2 tab, 15 ref.

Descriptors: *Activated sludge, *Chromium, *Industrial wastes, *Toxicity, *Wastewater treatment, Biomass, Growth kinetics, Heavy metals, Tannery wastes, Tolerance.

Hexavalent chromium, which is frequently encountered in tannery effluents and in the electroplating wastes, is normally considered toxic to the activated sludge culture. Often a physico-chemical pretreatment prior to biological treatment is considered necessary. However, it is shown that an acclimatized activated sludge culture is fully capable of coping with the Cr(VI)-containing wastes and moreover the culture was significantly stimulated by up to 25 mg/L. None of the tested concentrations of this metal were inhibitory to the mixed culture under investigation. In fact, all of the concentrations tested (1, 5, 10, and 25 mg/l Cr(VI)) significantly stimulated maximum growth rate, of the culture. Furthermore, the biomass yield of the activated sludge culture markedly increased in the presence of Cr (VI) while the effect on the biomass decay or maintenance constant was variable. (Author's abstract)
W91-06866

DECHLORINATION OF CHLORENDIC ACID WITH OZONE.

State Univ. of New York at Buffalo. Dept. of Civil Engineering.
J. P. Stowell, and J. N. Jensen.
Water Research WATRAG, Vol. 25, No. 1, p 83-90, January, 1991. 6 fig, 3 tab, 25 ref.

Descriptors: *Chemical degradation, *Chlorinated hydrocarbons, *Dechlorination, *Oxidation, *Ozonation, *Ultraviolet radiation, Bicarbonates, Chlorendic acid, Decontamination, Hydrogen ion concentration, Model studies, Ozone, Textile mill wastes, Wastewater treatment.

Chlorendic acid is introduced into the environment from flame proofing operations in the textile industry and the hydrolysis of cyclopentadiene pesticides. Due to its potential for large environmental loadings, potential health effects, and resistance to biological and chemical degradation, it is of environmental concern. The dechlorination and subsequent degradation of chlorendic acid by ozonation is influenced by the pH, applied ozone dose, and bicarbonate concentration. A change in the initial chlorendic acid concentration to 50, 100 and 200 mg/L did not influence the rate of degradation of chlorendic acid. Ultraviolet radiation alone also dechlorinated chlorendic acid. Ultraviolet radiation (u.v.) was shown to greatly enhance the oxidation of chlorendic acid in the presence of ozone. In a typical case, 80% dechlorination of chlorendic acid was obtained in 60 min when using an ozone dose of 125 mg/min ozone at pH 7.4. In addition to the experimental results, pseudo-first order rates were calculated for a two-step model and ranged from 0.002 to 0.295 /min for the first step and 0.008 to 0.000000000006 /min for the second step. The magnitude of the rate constants and corresponding rates of dechlorination of chlorendic acid were shown to be dependent upon the production and/or scavenging of hydroxyl radicals in solution. Conditions favoring radicals in solution, such as high pH and the addition of u.v., resulted in much faster dechlorination. The conditions which did not favor radicals, such as low pH and the addition of bicarbonate, resulted in slower dechlorination. (Doyle-PTT)
W91-06868

METHOD FOR THE SAMPLING AND REMOVAL OF IONIC ALKYLLEAD COMPOUNDS FROM AQUEOUS SOLUTION USING ION EXCHANGE MEDIA.

Lancaster Univ. (England). Inst. of Environmental and Biological Sciences.
For primary bibliographic entry see Field 5G.
W91-06869

BIODEGRADABLE PLASTICS FROM POTATO WASTE DOUBLE SAVINGS TO ENVIRONMENT.

Argonne National Lab., IL. Environmental Research Div.
R. Coleman.
Agricultural Engineering AGENAZ, Vol. 71, No. 6, p 20-22, November 1990. 1 fig.

Descriptors: *Environmental protection, *Food-processing wastes, *Plastics, *Potatoes, *Recycling, *Waste utilization, Argonne National Laboratory, Bacteria, Cost analysis, Economic aspects, Enzymes, Fermentation, Fertilization, Films, Glucose, Groundwater pollution, Starch, Waste recovery, Water pollution control.

Researchers at Argonne National Laboratory, Argonne, Illinois, have developed a way to turn starchy food waste into photodegradable and biodegradable plastics. This technology would deliver a double benefit to the environment by keeping the waste from polluting groundwater while returning the plastic safely to the environment. The process involves enzymatically converting the starch in potato or other high-carbohydrate waste into glucose, fermenting the glucose to lactic acid using bacteria, and then using the lactic acid to construct degradable plastics. Potential markets for the plastics are as mulch films and compost bags, as well as programmable fertilizer and pesticide delivery systems for sustained release using plastics that degrade during the course of the growing season. The unit price of production is estimated at $0.54 per pound for a plant processing 20 million pounds of waste starch a year; target cost of production is less than $0.40 per pound by optimizing bench level and pilot plant scale systems. (Doria-PTT)
W91-06872

PURIFICATION OF HIGHLY CONTAMINATED WASTE WATERS BY USING CEMENT DUST: A POSSIBLE APPROACH.

National Research Centre, Cairo (Egypt).
N. Salem.
Agrochimica AGRCAX, Vol. 34, No. 4, p 352-362, August 1990. 2 fig, 2 tab, 13 ref.

Descriptors: *Cement dust, *Filtration, *Heavy metals, *Separation techniques, *Waste utilization, *Wastewater treatment, Cements, Cobalt, Copper, Manganese, Path of pollutants, Zinc.

The removal of heavy metals (Zn, Mn, Cu, and Co) from a municipal wastewater using cement dust was examined in laboratory tests. The presence of these metals in wastewaters has been linked to bioaccumulation of metals in plants and animals when water is extracted from polluted rivers and streams for agricultural use. Wastewater from a municipal treatment plant was spiked with 500 mg/L of Zn, Mn, Cu and Co and then treated with cement dust (from 2 to 10 g/L) taken from the air filter of a cement plant. Results showed that the concentration of all heavy metals in the treated water was practically negligible. In another experiment, solutions containing Cu, Zn, Mn, and Co at concentration of up to 1000 mg/L of each element were treated with cement dust (from 2 to 30 g/L). Results showed a very high efficiency of this material to reduce the concentration of heavy metals. The final concentrations of metals were practically negligible for all doses higher than 15 g/L. These experiments suggest a possible approach to purify highly contaminated wastewater by utilizing cement dust, an industrial byproduct for which several problems of disposal and environmental hazards exist. (Geiger-PTT)
W91-06897

MINIMIZING MUNICIPAL LIABILITY UNDER NEW FEDERAL PRETREATMENT REGULATIONS.

Zorc, Risseto and and Weaver, Washington, DC.
G. B. Cohen.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 24, No. 1, p 12-13, January/February 1991.

Descriptors: *Liability, *Municipal wastewater, *Pretreatment of wastewater, *Regulations, *Wastewater treatment, *Water law, Enforcement, Hazardous wastes, Industrial wastes, Permits, Testing procedures, Toxicity.

The Environmental Protection Agency amended the federal pretreatment and National Pollutant Discharge Elimination System permit application regulations on July 24, 1990. These new regulations generally impose additional pretreatment responsibilities upon municipal pretreatment programs and their industrial users. Significant changes include establishment of: strict enforcement commitments through the Enforcement Response Plan process; toxicity testing permit application requirements for certain municipalities; additional specific prohibitions under C.F.R. 403.5; minimum sampling and inspection frequency of significant industrial users; compliance reporting for non-categorical significant industrial users; significant industrial user permitting requirement; regulatory definitions of significant industrial users and significant noncompliance; local limit technical evaluation requirements; slug load planning process; and industrial user reporting of hazardous wastes discharged to a publicly owned treatment works (POTW). The POTW can establish its own standards for judging the adequacy of the local pretreatment program. The new pretreatment regulations now require an Enforcement Response Plan as an accountability (and liability) standard for POTW enforcement actions. The Enforcement Response Plan must describe the types of escalating enforcement responses the POTW will take to all anticipated types of industrial user violations and time periods within which responses will take place. (Geiger-PTT)
W91-06912

CASE HISTORY OF PERFORMANCE TEST OF THE CARROUSEL PROCESS AT EASTON, PENNSYLVANIA.

PSC Engineers and Consultants, Inc., Lancaster, PA.
L. E. Ritter.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 24, No. 1, p 17-21, January/February 1991. 1 fig, 1 tab, 3 ref.

Descriptors: *Ammonia removal, *Biological wastewater treatment, *Clarification, *Oxidation ditches, *Pennsylvania, *Wastewater treatment, Aeration, Biochemical oxygen demand, Delaware River, Nitrification, Performance evaluation, Suspended solids.

The performance of a 7.0 MGD Carrousel type oxidation ditch at the recently upgraded Easton Area Joint Sewer Authority wastewater treatment plant was tested for removal of ammonia nitrogen, BOD, and suspended solids. The influent wastewater preliminary treatment consists of grit removal in an aerated grit chamber followed by comminution. Next, the wastewater is settled in two primary clarifiers. Primary sludge and skimmings are removed. The primary effluent is pumped to a three-train type Carrousel oxidation ditch which along with the three circular clarifiers removes most of the remaining BOD. Ammonia-nitrogen is nitrified and total suspended solids are removed to a level acceptable for discharge. The clarified effluent is then disinfected prior to its discharge to the Delaware River. During the performance test, the average mixed liquor suspended solids was 3710 mg/L. The food to microorganisms ratio averaged 0.04. A clarifier sludge blanket of 3.0 feet and a return sludge rate of 124% was maintained. The sludge volume index averaged 172. A yield of excess sludge averaged 91,700 gallons per day and the pounds of yield per pound of BOD removed was calculated to be about 1.0. The aerator dissolved oxygen averaged 0.60 mg/L when measured at the designated measurement point. The plant was capable of producing a high quality effluent and a large quantity of excess sludge. The unused nitrification capacity should be beneficial in getting the plant rated to a higher capacity. To minimize secondary clarifier denitrification, it was necessary to expand anoxic zones of oxidation ditches to greater than 50% of oxidation ditch volume. (Geiger-PTT)
W91-06914

NEW CHEMICAL TREATMENT FOR ENHANCED PHOSPHORUS REMOVAL FROM WASTEWATER USING BLENDS OF ALUMINUM CHLORIDE AND POLY-ALUMINUM CHLORIDE.

Villanova Univ., PA. Dept. of Chemical Engineering.
D. D. Joye.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 24, No. 1, p 23-26, January/February 1991. 12 ref.

Descriptors: *Aluminum chloride, *Chemical treatment, *Clarification, *Phosphorus removal, *Turbidity, *Wastewater treatment, Coagulants, Industrial wastewater, Lime, Municipal wastewater, Phosphates, Separation techniques.

Blends of aluminum chloride and poly-aluminum chloride have given very high removal efficiencies (over 99%) in both phosphorus and turbidity reduction in industrial and municipal wastewaters. The factors that affect the performance of these blends are still under investigation. Optimum blend ratios are in the range of 40-60% aluminum chloride by weight based on 75% of the optimum dose of aluminum chloride in the particular application; the optimum pH range is 5-7, the use of organic polymer coagulants improves the removal by 20-30% and reduces sludge volume, which is two to

three times higher with the blends than with aluminum chloride alone. The co-addition of lime aids in the removal of phosphorus, particularly when dissolved phosphates are present in significant amounts. The improvement is about 30% at pH 6. (Author's abstract)
W91-06915

SURGING IN URBAN STORM DRAINAGE SYSTEMS.
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Q. Guo, and C. C. S. Song.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1523-1537, December 1990. 12 figs, 15 ref, 1 append.

Descriptors: *Hydrodynamics, *Model studies, *Sewer hydraulics, *Storm drains, *Storm runoff, *Unsteady flow, *Urban hydrology, Flow discharge, Flow models, Illinois, Mathematical equations, Mathematical models, Reservoir design.

The existence of surge and related problems, namely, sharp-peaked overflows, manhole, or drop-shaft cover blow-off; waterjets into the atmosphere (geysers); and structural damages in urban storm drainage systems, are described conceptually and illustrated with both a mathematical model and field records. A storm sewer tunnel in the system may be pressurized if its conveyance capacity is exceeded or if it is also used for storage. The pressurization process is assocaited with the movement of a surge that separates the free-surface flow regime from the pressurized flow regime. Analysis of the surge movement characteristics revealed that the surge strength at the end of the pressurization process determines the extent of the surge problems. Operational and structural methods to reduce the surge strength are proposed and evaluated for the Mainstream System and the O'Hare System of the Tunnel and Reservoir Plan in Chicago, Illinois. They include inflow regulation, initial storage regulation, use of downstream reservoir, and use of an upstream surge tank. (Author's abstract)
W91-07033

5E. Ultimate Disposal Of Wastes

ABOVE-GROUND LANDFILL: THE ENGINEERED APPROACH.
A. Street, and J. P. Dumble.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 430-435, October 1990. 4 ref.

Descriptors: *Landfills, *Solid wastes, *Waste disposal, *Waste management, Civil engineering, Design standards, Monitoring, United Kingdom, Water pollution control.

Landfilling is the principal means of disposal for 90% of controlled waste arising in the United Kingdom. Historically, the approach to landfill development in the UK has been to utilize voids formed as a result of mineral extraction. Due to the green movement, more stringent environmental controls are being introduced both at the national and international level. Landfill design today must be well engineered, operated and restored. Key issues must be addressed: site identification and assessment; peripheral bunding; filing and compaction; drainage; water management; landfill gas management; and monitoring programs. (Feder-PTT)
W91-05969

ELUTION OF ENDRIN THROUGH COMPACTED SOIL WITH ETHANOL-WATER MIXTURES.
Trevecca Nazarene Coll., Nashville, TN.
For primary bibliographic entry see Field 5B.
W91-06021

UNSTEADY TRANSPORT OF POLLUTANTS IN RIVERS DUE TO PULSE DISPOSAL.
Institute of Technology, Baghdad (Iraq). Dept. of Irrigation.
For primary bibliographic entry see Field 5B.
W91-06059

BACTERIA AND VIRUS REMOVAL FROM SECONDARY EFFLUENT IN SAND AND RED MUD COLUMNS.
Murdoch Univ. (Western Australia). School of Biological and Environmental Sciences.
For primary bibliographic entry see Field 5D.
W91-06068

SUPERCRITICAL WATER OXIDATION--WASTEWATERS AND SLUDGES.
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W91-06081

STABILIZATION OF HAZARDOUS MATERIALS INTO FERRITES.
Tokyo Inst. of Tech. (Japan). Dept. of Chemistry.
Y. Tamaura, P. Q. Tu, S. Rojarayanont, and H. Abe.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 399-404, 1991. 2 fig, 3 tab, 5 ref.

Descriptors: *Ferrite process, *Hazardous waste disposal, *Sludge disposal, *Waste disposal, *Waste stabilization, *Waste treatment, Adsorption, Oxidation, Environmental protection, Heavy metals, Leaching, Wastewater treatment.

Stabilization of hazardous materials by the Fe3O4-coating method provides a chemically and mechanically stable layer between the waste and the environment. In the ferrite-formation reaction in an aqueous solution, the adsorption of the metal ions and the oxidation of the adsorbed Fe(II) ions are repeated on the surface of the ferrite particles. This reaction was adapted to the coating of hazardous materials. By repeating the two steps of (1) the addition of the Fe(II) aqueous solution into the suspension of the hazardous materials, and (2) the oxidation by passing air through the reaction suspension, a Fe3O4 layer coats the surfaces of the hazardous materials. Potential uses include the heavy metal sludge from neutralization/precipitation processes, CaF2 precipitates from the treatment of wastewaters containing fluoride, and soils containing the Cd(II) ion. These ferrite coated materials are very stable and no heavy metal ions are leached under normal environmental conditions. The ferrite sludges formed in the ferrite process were highly stabilized by this method and heat treatment. (Author's abstract)
W91-06082

METHODS TO SET SOIL CLEANUP GOALS TO PROTECT SURFACE AND GROUND WATER QUALITY AT HAZARDOUS WASTE SITES.
Environmental Resources Management, Inc., Exton, PA.
For primary bibliographic entry see Field 5G.
W91-06083

BIOLOGICAL TREATMENT OF A LANDFILL LEACHATE CONTAINING PHENOXY HERBICIDES AND CHLOROPHENOLS.
Massey Univ., Palmerston North (New Zealand). Dept. of Biotechnology.
For primary bibliographic entry see Field 5D.
W91-06084

ENVIRONMENTAL ASPECTS OF STABILIZATION AND SOLIDIFICATION OF HAZARDOUS AND RADIOACTIVE WASTES.
Papers presented at the Fourth International Hazardous Waste Symposium on Environmental Aspects of Stabilization/Solidification of Hazardous and Radioactive Wastes, May 3-6, 1987, Atlanta, GA. STP 1033. ASTM, Philadelphia, PA, 1989. 440p. Edited by Pierre Cote and Michael Gilliam.

Descriptors: *Hazardous wastes, *Radioactive wastes, *Waste disposal, *Waste solidification, *Waste stabilization, *Waste treatment, Case studies, Chemical treatment, Land disposal, Regulations, Symposium, Waste containment.

Stabilization and solidification have been used for two to three decades as final treatment steps prior to land disposal of radioactive and chemically hazardous wastes. These technologies are also playing an increasingly important role for on-site or in-situ treatment and remediation of waste lagoons or contaminated soils. Stabilization refers to those aspects of the technology which result in rendering a waste less toxic through fixation of the contaminants and/or by providing a stable chemical environment. Solidification is related to those operations which improve the physical and handling characteristics of the waste. The publication contains 33 peer-reviewed papers out of 62 that were presented at the 4th International Hazardous Waste Symposium on Environmental Aspects of Stabilization/Solidification of Hazardous and Radioactive Wastes. Fourteen papers deal with radioactive wastes, 16 with chemically hazardous wastes, and 3 with mixed wastes. The papers are grouped into four chapters that deal with: (1) Processes, (2) Regulatory Aspects and Testing Methods, (3) Laboratory Evaluation, and (4) Large-scale Evaluation or Demonstration. (See W91-06125 thru W91-06157) (Lantz-PTT)
W91-06124

SOLIROC PROCESS IN NORTH AMERICA: A STABILIZATION/SOLIDIFICATION TECHNOLOGY FOR THE TREATMENT OF METAL-BEARING WASTES WITH REFERENCE TO EXTRACTION PROCEDURE TOXICITY TESTING.
Tricil Environmental Services, Antioch, TN.
For primary bibliographic entry see Field 5D.
W91-06125

SYSTEMATIC APPROACH FOR THE DESIGN OF PUMPABLE, CEMENT-BASED GROUTS FOR IMMOBILIZATION OF HAZARDOUS WASTES.
Oak Ridge National Lab., TN. Chemical Technology Div.
T. L. Sams, and T. M. Gilliam.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 15-20, 1 fig, 13 ref. DOE Contract No. DE-AC05-84OR21400.

Descriptors: *Cements, *Grouting, *Hazardous wastes, *Waste disposal, *Waste solidification, Design standards, Permeability, Radioactive wastes, Waste containment.

Versatile and inexpensive processes to solidify large quantities of radioactive liquids, sludges and fine solids in cement based grouts have been developed and are used routinely for the ultimate disposal of radioactive wastes. Grout monoliths have been shown to be less permeable than the surrounding host and resistant to: (1) leaching by groundwater, (2) deterioration on exposure to radiation or thermal cycling, and (3) overburden subsidence. Recent studies have shown that similar product performance can be obtained upon application of these processes to the disposal of chemically hazardous or mixed wastes. Disposal costs can be further reduced if the cement based grout is formulated to be sufficiently fluid so that it can be pumped to the disposal area where it hardens in situ to form large grout monoliths. A systematic approach has been developed that can be used to rapidly extend the application of grout technology to disposal of chemically hazardous wastes. (See also W91-06124) (Lantz-PTT)
W91-06126

USE OF BITUMEN IN THE STABILIZATION OF MIXED WASTES.
Associated Technologies, Inc., Charlotte, NC.
D. P. Swindlehurst, R. D. Doyle, and A. J. Mattus.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 21-27, 1 fig, 5 tab, 4 ref.

Descriptors: *Bitumen, *Hazardous waste disposal, *Hazardous wastes, *Waste disposal, *Waste solidification, *Waste stabilization, *Waste treatment, Asphalt, Cesium, Leaching, Strontium, Toxicity.

Mixed wastes pose a problem to their generators since there are no burial sites or treatment facilities currently accepting this type of waste. One potential disposal method is to treat the waste in a way that renders it nonhazardous, and the disposing of it in accordance with radioactive waste requirements. One possible method for accomplishing this transformation is to solidify the waste in asphalt (bitumen). A surrogate sodium nitrate-based waste was spiked with extraction procedure (EP) toxic metals and nonradioactive cesium and strontiu. The final solution created was solidified in asphalt. The physical properties of the solidified end product allow for its disposal. The waste samples generated underwent EP toxicity testing as well as American Nuclear Society (ANS) 16.1 leach testing for 90 days. It is evident, from the testing performed, that the solidification of certain mixed wastes in asphalt can result in a waste no longer considered hazardous. This would permit the disposal of the waste in accordance with regulations for radioactive wastes alone. Primarily it allows for the final disposal of the waste rather, than requiring its indefinite storage. (See also W91-06124) (Lantz-PTT)
W91-06127

LEACHING AND COMPREHENSIVE REGULATORY PERFORMANCE TESTING OF AN EXTRUDED BITUMEN CONTAINING A SURROGATE, SODIUM NITRATE-BASED, LOW-LEVEL WASTE.
Martin Marietta Energy Systems, Inc., Oak Ridge, TN.
A. J. Mattus, M. M. Kaczmarsky, and C. K. Cofer.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 28-39, 3 fig, 7 tab, 9 ref. DOE Grant No. DE-AC05-84OR21400.

Descriptors: *Bitumen, *Hazardous waste disposal, *Hazardous wastes, *Leaching, *Performance evaluation, *Regulations, *Waste solidification, Asphalt, Cesium, Heavy metals, Materials testing, Sodium nitrate, Standards, Strontium, Toxicity.

A relatively viscous form of oxidized bitumen (ASTM D 312, Type III) has been tested for its ability to contain a surrogate, sodium nitrate-based waste, and was shown to meet all of the current regulatory criteria. Molded specimens were obtained using a 53-mm Werner and Pfleiderer extruder. A surrogate, low-level, mixed liquid waste, formulated to represent an actual on-site waste at the Oak Ridge National Laboratory, was used. The surrogate waste contained approximately 30 weight percent sodium nitrate, in addition to eight heavy metals, cold cesium, and strontium. Waste from specimens contained three levels of waste loading: 40, 50, and 60 weight percent salt. Thermal analysis of the waste forms has revealed that material is capable of combustion at temperatures which are almost twice as high as the highest process temperature and greater than the melting point of sodium nitrate. The magnitude of the flash-point and ignition-point data were also found to generally agree with data reported elsewhere. The high volume-reduction efficiency observed with this type of thermal waste fixation process offers potential transportation and storage cost savings. Long-term leach testing is continuing in order to observe the effects of the physical changes occurring to the waste forms, as described, over a period of one year. (See also W91-06124) (Lantz-PTT)
W91-06128

SURFACE ENCAPSULATION PROCESS FOR STABILIZING INTRACTABLE CONTAMINANTS.
Environmental Protection Polymers, Inc., Hawthorne, CA.
S. L. Unger, R. W. Telles, and H. R. Lubowitz.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 40-52, 14 fig, 2 tab, 4 ref.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Surface encapsulation, *Waste disposal, *Waste stabilization, Design standards, Organic compounds, Polybutadiene, Radioactive wastes, Resins, Waste solidification.

Organic resins are the material of choice for fabrication of modules for pollutant stabilization because of their excellent chemical stability. Cost effective, high performance pollutant stabilization/solidification by resin modules requires both judicious resin selection and module design. Polybutadiene resin was identified as an excellent material for binding pollutant particles and forming agglomerates. Agglomerates holding more than 90% by weight pollutants were readily prepared. They were reinforced by fusing polyethylene resin pellets onto their surfaces, thereby encapsulating agglomerates by seamless resin jackets. Testing of lab-scale models holding toxic wastes demonstrated their outstanding stability under harsh physical, chemical and mechanical stresses. Based on successful the stabilization/solidification of many types of pollutants on a lab-scale, the process was scaled up. The work included design and construction of a prototype apparatus for fabricating commercial-size modules. A model is cylindrical in shape, has a capacity of 182 L, and is 61 cm high and 61 cm in diameter. In securing sodium sulfate, a pollutant formed in nuclear plants, the module weighs 325 kg, holds 87% by weight salt in a thermoset polybutadiene matrix, and is reinforced by seamless, 0.95 cm thick high density polyethylene jackets. (See also W91-06124) (Lantz-PTT)
W91-06129

PROCESS FOR SOLIDIFYING SODIUM NITRATE WASTE IN POLYETHYLENE.
Nuclear Waste Research Group, Fuel Cycle Analysis Division, Brookhaven National Laboratory, Associated University, Inc., Upton NY 11973.
J. H. Heiser, E.-M. Franz, and P. Colombo.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 53-62, 6 fig, 4 tab, 14 ref.

Descriptors: *Hazardous waste disposal, *Polyethylene, *Sodium nitrate, *Waste disposal, *Waste solidification, *Waste stabilization, Calorimetry, Extrusion, Hazardous wastes, Leaching, Organic compounds, Waste containment.

A laboratory-scale process has been developed for the solidification of nitrate salt wastes in polyethylene. The process uses a commercially available single-screw extruder which continuously discharges prescribed polyethylene-waste mixtures from the hoppers to the output die, where it is extruded into a container while still in the molten form. The molten mixture (about 110 to 120 C) conforms to the shape of the container and solidifies upon cooling. Proportional feeders maintain waste-to-binder ratio and homogeneity of the waste form. Present studies use dry wastes, although wet solid wastes can be processed using vented extruders of the type used for the bitumen solidification process. Tests were performed to determine leachability and mechanical stability. Emphasis is placed upon leaching of nitrates from the waste forms. Leach tests were performed according to American Nuclear Society (ANS) 16.1 as well as the EPA extraction procedure (EP). For polyethylene waste forms containing 30 to 40 weight percent sodium nitrate, ANS 16.1 leach indices range from 11 to 7.8, respectively. Compressive yield strengths range from 18 to 5 MPa (after 90 days' water immersion). The results of the EP indicate that the nitrate release levels for waste forms containing as much as 70 weight % sodium nitrate are not defined as characteristically hazardous waste. Differential scanning calorimetry (DSC) was used to confirm the compatibility of polyethylene and simulated salt wastes at elevated temperatures. Components of the polyethylene/sodium nitrate system, alone and in combination, were tested by DSC at temperatures to 400 C. At these temperatures, no chemical interactions were observed between polyethylene and nitrate waste compositions. (See also W91-06124) (Author's abstract)
W91-06130

DEVELOPMENT OF A COMPOSITE POLYETHYLENE--FIBERGLASS-REINFORCED-PLASTIC HIGH-INTEGRITY CONTAINER FOR DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE.
Lowenberg Associates, Inc., Rockville, MD.
H. Lowenberg, and M. D. Shaw.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 63-73, 13 fig.

Descriptors: *Fiberglass, *Materials testing, *Polyethylene, *Radioactive waste disposal, *Radioactive wastes, *Waste disposal, Design standards, Performance evaluation, Pressure, Strength, Waste stabilization.

A program has been initiated to develop a high integrity container (HIC) for handling, transporting and disposing of low level radioactive wastes. The HIC, made of a composite material, consists of an inner layer of polyethylene bonded to an outer casing of fiberglass reinforced plastic. Preliminary handmade prototype units containing about 0.22 cu m, called HIC-7, have been fabricated and exposed to some of the most demanding tests. The HICs withstood over twice the external pressure from maximum burial conditions, and twice the Type A package internal pressure requirements. In addition, free drops on compacted soil and an unyielding surface showed no deleterious effects. The composite material has been tested for mechanical properties, such as tensile, comprehensive, and bond shear strengths, creep, thermal expansion, and hardness. In addition, specimens have been exposed to environments including thermal cycling, gamma and ultraviolet radiation, biodegradation from fungi and bacteria, and internal and external chemical corrosion followed by mechanical testing. Prototype production units have been tested to the full range of NRC and state requirements. This work demonstrates the HIC's ability to meet all NRC and state requirements for the disposal of LLW including: (1) integrity of the welded PE closure seal; (2) outstanding HIC corrosion and radiation resistance; (3) high HIC strength-to-weight ratio; (4) excellent volumetric efficiency of 85 to 90%; and (5) more than adequate physical and chemical properties. (See also W91-06124) (Lantz-PTT)
W91-06131

NUCLEAR REGULATORY COMMISSION REGULATIONS AND EXPERIENCE WITH SOLIDIFICATION/STABILIZATION TECHNOLOGY.
Nuclear Regulatory Commission, Washington, DC. Low-Level Waste Licensing Branch.
T. Jungling, and J. Greeves.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 77-82, 2 tab.

Descriptors: *Nuclear Regulatory Commission, *Radioactive waste disposal, *Regulations, *Waste disposal, *Waste solidification, Classification, Radioactive wastes, Waste management.

Two important areas in the US Nuclear Regulatory Commission regulations for low-level waste management, 10 CFR Part 61, involve the requirements for waste classification and waste form. The waste classification system establishes three categories of wastes acceptable for near surface disposal. These categories are determined by the concentrations of nuclides important for disposal. Class A wastes have low concentrations and need only meet minimum waste form requirements. Class B and C wastes have higher concentrations and are required to have stability to minimize disposal trench subsidence effects. This rule established performance objectives for the land disposal of radioactive waste, minimum technical requirements for a near-surface disposal facility, and the licensing

procedures NRC will follow in licensing new disposal capacity for low-level radioactive waste. The performance objectives established in 10 CFR Part 61 are: (1) protection of the general population from releases of radioactivity; (2) protection of individuals from inadvertent intrusion; and (3) protection of individuals during operations. (See also W91-06124) (Author's abstract)
W91-06132

CHARACTERIZATION AND CONTROL OF SOLIDIFIED RADIOACTIVE WASTES ACCORDING TO THE ITALIAN RULES: ORGANIZATION OF A CHARACTERIZATION FACILITY AND FIRST RESULTS.
ENEA, Rome (Italy). Nuclear Fuel Cycle Div.
G. A. Ricci, and A. Donato.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 83-92, 6 fig, 3 tab, 2 ref.

Descriptors: *Italy, *Radioactive waste disposal, *Radioactive wastes, *Waste disposal, *Waste management, *Waste solidification, *Waste stabilization, Asphalt, Bitumen, Cements, Classification, Nuclear powerplants, Radioactivity, Waste containment.

Three 'radwaste' categories have been established in Italy. The first refers to wastes that decay below exemption limits for free discharge, as defined by current Italian laws, within a few months or a few years, maximum. The second category of radwaste, which is the most important in terms of overall production, refers to those wastes whose radioactivity decays to levels comparable to the exemption limits set up for natural radioactive solids within a few centuries, maximum. The radwastes in the second category, which are generated mainly by nuclear powerplants, must be solidified by agents such as cement, bitumen or polymers. Test programs must be performed to assure compliance with a set of specified waste form characteristics. The third category of radwaste refers to the high-activity liquids created during the first cycle of fuel reprocessing facilities and to alpha-bearing wastes. The tests to be applied for the characteristic control of real radioactive solidified wastes of the second category sometimes require that a noncommercial apparatus be operated in radiation controlled areas. A glove box chain, suitable for the characterization of solidified alpha wastes has been designed and built. Tests confirm the difficulty experienced during the direct conditioning of bead ion exchange resins and Powdex ion-exchange resins in cement; the amount of exhausted ion-exchangers should be kept low, in the range of 0.15 to 0.25 wet-waste/cement ratio. (See also W91-06124) (Lantz-PTT)
W91-06133

QUALITY-ASSURANCE PROCEDURE FOR USE AT TREATMENT PLANTS TO PREDICT THE LONG-TERM SUITABILITY OF CEMENT-BASED SOLIDIFIED HAZARDOUS WASTES DEPOSITED IN LANDFILL SITES.
UKAEA Atomic Energy Research Establishment, Harwell (England).
P. E. Rushbrook, G. Baldwin, and C. B. Dent.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 93-113, 9 fig, 4 tab, 18 ref.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Landfills, *Quality control, *Waste disposal, *Waste management, *Waste solidification, *Waste stabilization, *Waste treatment, *Wastewater facilities, Hazardous waste treatment, Hydraulic conductivity, Leaching, Physical properties, Strength.

An investigation was conducted to study the physical and leaching characteristics of the solidified products derived from mixing hazardous wastes cement and pulverized fuel ash (PFA). The proportion of cement, PFA and hazardous waste varied over a wide range. Where possible, relationships between the physical characteristics of the solidified waste and its chemical composition were elucidated. The work has culminated in the development of a new concept to predict, at the time of mixing, whether the future physical and leaching behavior of a batch of solidified hazardous waste will satisfactorily meet regulatory requirements. Findings are based on the results of many trial mixes which were prepared using actual hazardous wastes commonly treated by solidification in the United Kingdom. For each mix, five parameters were measured: rate of settling, hydraulic conductivity, compressive strength, leachate composition, and supernatant retention. The results were used to prepare a quality control chart based upon reasonable standards which would be expected in the United Kingdom for a solidified product. On each control chart there is a region defining acceptable proportions of waste, cement, and PFA. This region of acceptability is likely to be dependant upon the chemical nature of the bulk waste streams at a treatment plant site. (See also W91-06124) (Lantz-PTT)
W91-06134

CRITICAL REVIEW OF EVALUATION PROCEDURES FOR STABILIZATION/SOLIDIFICATION PROCESSES.
Oxford Univ. (England). Dept. of Metallurgy.
C. S. Poon.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 114-124, 1 fig, 47 ref.

Descriptors: *Performance evaluation, *Testing procedures, *Waste disposal, *Waste solidification, *Waste stabilization, Cements, Chemical properties, Diffusion, Hazardous wastes, Heavy metals, Leaching, Model studies, Path of pollutants, Physical properties, Strength.

Leaching procedures for the evaluation of cement-based stabilization/solidification processes are considered through the relative merits and shortcomings of the equilibrium and dynamic leaching test approaches and various leaching models. Although mass transport and diffusion models have been generally used to describe the leaching behavior of soluble species, the use of these models to describe the cement-solidified heavy metal waste is questioned. This is based on theoretical considerations of the interaction between cementitious materials, and waste and experimental evidence of the leaching characteristics. An alternative approach toward modeling the leaching behavior of the solidified waste is presented. Because the performance of the solidified material is also dependent on the physical properties of the waste form, a physical test procedure in conjunction with an appropriate leach test is proposed as necessary to evaluate the quality of the solidified waste. It is suggested that for cement-based solidified wastes (especially for heavy metal wastes), the acid-neutralizing capacity of the waste form should be determined first by titration. Also, the time of the potential breakthrough point should be determined. The leach profile of the waste components before this breakthrough point is more difficult to assess because most of the short-term extraction test data are not extrapolatable to predict the long-term leaching in field condition. However, taking into account the strength and extractability, that would most likely affect leaching, the leach profile can be formulated through an empirical relationship. (See also W91-06124) (Author's abstract)
W91-06135

LEACHING CHARACTERISTICS OF CONSTRUCTION MATERIALS AND STABILIZATION PRODUCTS CONTAINING WASTE MATERIALS.
Netherlands Energy Research Foundation ECN, Petten.
H. A. van der Sloot, G. J. de Groot, and J. Wijkstra.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 125-149, 14 fig, 9 tab, 21 ref. European Community Contract EN3F-0032-NL and Management Office for Energy Research Contract No. 20.51-013.10.

Descriptors: *Construction materials, *Hazardous waste disposal, *Hazardous wastes, *Leaching, *Materials testing, *Path of pollutants, *Waste stabilization, *Waste utilization, Alkalinity, Boron, Chemical analysis, Fluorine, Hydrogen ion concentration, Molybdenum, Sulfates, Testing procedures, Trace elements, Vanadium, Water pollution sources.

Several construction materials prepared with an admixture of waste material and various stabilized waste products have been subjected to leaching studies in order to determine the leaching behavior of trace elements from the materials to be characterized. Static and dynamic leach tests have been applied in which the specimen to be studied is fully immersed in demineralized water. Often the leaching process is governed by the outward diffusion of constituents dissolved in the pore water. In some cases, dissolution from the surface of the product is most prominent, and in some materials short-term surface releases have been observed. Groups of materials can be distinguished by their similarities in the leaching behavior of trace elements. The alkalinity of the material, the open porosity of the product, and the surface to volume ratio prove to be important factors in controlling the release of potential hazardous elements from materials containing waste products. In these studies, leach parameters of trace elements are related to those of sodium. Since the interaction of sodium with the solid phase is usually small, sodium can be used as an indicator for the tortuosity of the product. Elements leached from cement-based waste products are mainly anionic species, like MoO4, BO3, VO4, F, and SO4, whereas leaching of metals such as copper, cadmium, zinc, and lead is limited due to the high pH in the pore solution. The leaching experiments have been verified by scanning electron microscopy for major components in field samples and by measuring depth profiles in waste products for trace constituents using an apparatus developed for this purpose. (See also W91-06124) (Author's abstract)
W91-06136

EXTRACTION PROCEDURE TOXICITY AND TOXICITY CHARACTERISTIC LEACHING PROCEDURE EXTRACTIONS OF INDUSTRIAL AND SOLIDIFIED HAZARDOUS WASTE.
CH2M Hill, Boston, MA.
W. E. Shively, and M. A. Crawford.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 150-169, 5 fig, 7 tab, 4 ref.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Industrial wastes, *Leaching, *Performance evaluation, *Toxicity, *Waste disposal, *Waste management, *Waste solidification, Chemical analysis, Chemical treatment, Metal-finishing wastes, Organic compounds, Sludge, Volatile organic compounds.

An evaluation is made of the performance of commercial hazardous waste treatment, storage and disposal facilities (TSDFs). Five facilities were sampled representing a wide range of treatment processes. Sampling was performed to monitor all influent, effluent and treatment residues associated with each process. Leaching evaluations of industrial waste treatment residues and solidified/stabilized wastes were conducted via extraction procedure (EP) toxicity tests for metals and toxicity characteristic leaching procedure (TCLP) analyses for metals, volatile organic compounds (VOCs), and semi-volatile organics. The results demonstrate that effective treatment has resulted in non-hazardous residues in the majority of the cases. In several instances, the TCLP results for treatment residues are not within the recently promulgated regulations. Waste composition and leachate results before and after treatment were compared, and metal hydroxide sludges from hydroxide precipitation processes were tested. A waste oil, a paint sludge, a biological treatment pond sludge, and a metal hydroxide plating sludge were tested before and after fly ash solidification. Plating wastes mixed with acids and neutralized with lime were tested with excess lime. Two ash residues pro-

duced by different solvent incinerators were tested. Compositional analyses showed varying quantities of organic compounds. (See also W91-06124) (Lantz-PTT)
W91-06137

LEACHING CHARACTERISTICS OF SELECTED ELEMENTS FROM COAL FLY ASH AS A FUNCTION OF THE ACIDITY OF THE CONTACT SOLUTION AND LIQUID/SOLID RATIO.
Netherlands Energy Research Foundation ECN, Petten.
G. J. de Groot, J. Wijkstra, D. Hoede, and H. A. van der Sloot.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 170-183, 9 fig, 9 ref. National Coal Research Programme, Management Office for Energy Research (PEO) Contract 4351.11.9.1 and Contract 20.53-021-10.

Descriptors: *Acidity, *Fly ash, *Leaching, *Path of pollutants, *Waste utilization, Aluminum, Cadmium, Chemical analysis, Chemical treatment, Copper, Environmental effects, Heavy metals, Hydrogen ion concentration, Lead, Silicon, Solubility, Testing procedures, Trace elements, Zinc.

To estimate the environmental consequences of the storage and utilization of coal fly ash in the Netherlands, a standard leaching test has been developed. In this test, leach conditions are used which aim at close approximation with field conditions. The standard test consists of three main parts: a column leaching test, a serial batch leaching test, and a test for the determination of maximum leachability. Tests which were conducted conclude that fly ashes from coal combustion show systematic leaching behaviors, allowing for a better understanding of this thermodynamically complex system. The three dimensional relations allow for an estimation of the element concentration in the fly ash/water system for any given liquid/solid (LS) ratio and pH condition. The uncertainty of this estimate is high in the steep gradients within these three dimensional plots. The leaching factor can be a significant factor only for a few elements for which the reaction kinetics are slow. A database with leaching data of waste materials and waste products, is an important tool for filling the voids in knowledge. The matrices obtained are particularly useful as input for modeling studies and for revealing the systematics in leaching behavior of ash/water systems. Five different ashes were submitted to the complete standard leaching test. All ashes show common leaching characteristics for several groups of elements. The elements present in the form of anionic species behave similarly. In contrast with literature information, limited solubility of anions at high pH (>11) has been observed. The metals lead, copper, cadmium, and zinc show minimum solubility at high pH, whereas major elements like aluminum and silicon show two minima in the pH range 7 to 9 and at pH values higher than 11. The latter was related to the formation of new mineral phases. These studies indicate that pH is the main factor in controlling the leachability. (See also W91-06124) (Lantz-PTT)
W91-06138

EVALUATING THE FREEZE-THAW DURABILITY OF PORTLAND CEMENT-STABILIZED-SOLIDIFIED HEAVY METAL WASTE USING ACOUSTIC MEASUREMENTS.
New Hampshire Univ., Durham. Dept. of Civil Engineering.
T. El-Korchi, D. Gress, K. Baldwin, and P. Bishop.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 184-191, 4 fig, 9 ref.

Descriptors: *Acoustics, *Freeze-thaw tests, *Heavy metals, *Portland cements, *Testing procedures, *Waste disposal, *Waste solidification, *Waste stabilization, Cadmium, Cements, Hazardous wastes, Physical properties, Seawater.

Stress wave propagation was used to assess the freeze-thaw resistance of portland cement solidified/stabilized wastes. The stress wave technique is sensitive to the internal structural deterioration independent of weight loss or visual observations. The freeze thaw resistance of a cement-solidified cadmium waste and control was evaluated. The control and cadmium wastes both showed poor freeze-thaw resistance. However, the addition of cadmium and seawater curing increased the resistance to more cycles of freezing and thawing. This was attributed to microstructural changes. (See also W91-06124) (Author's abstract)
W91-06139

DEVELOPMENT OF A LIQUID RELEASE TESTER.
Chemical Waste Management, Inc., Geneva, IL.
For primary bibliographic entry see Field 7B.
W91-06140

COMPARATIVE STUDIES OF METAL CONTAINMENT IN SOLIDIFIED MATRICES BY SCANNING AND TRANSMISSION ELECTRON MICROSCOPY.
Alberta Environmental Centre, Vegreville.
M. Neuwirth, R. Mikula, and P. Hannak.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 201-213, 6 fig, 3 tab, 15 ref.

Descriptors: *Comparison studies, *Data acquisition, *Hazardous wastes, *Heavy metals, *Scanning electron microscopy, *Waste disposal, *Waste solidification, *Waste stabilization, Cadmium, Electron microscopy, Laboratory methods, Leaching, Lead, Mercury, Zinc.

Solidification/stabilization processes are widely used for the disposal of metal containing industrial/hazardous wastes. There is little understanding of the mechanisms of metal containment in cementitious matrices. Leaching studies characterize the mechanism by which contaminants are released from the matrix, but give little information on contaminant-matrix interactions and the partitioning of contaminants within different phases of the solid structure. Recent studies have shown that different mechanisms are involved in stabilizing metals such as zinc and mercury, or cadmium and lead. Selected concentrations of metal salt solutions (cadmium, chromium, and lead) were stabilized using portland cement as an additive. Scanning electron microscopy (SEM), energy dispersive x-ray analysis (EDX), and backscattered electron detection were performed on fractured and polished surfaces of specimens. Transmission electron microscopy (TEM) and x-ray microanalysis were carried out on ground particles of approximately 1 micrometer in size from the same specimens. The results indicate that different containment mechanisms are responsible for stabilization of the metals used, and that they provide additional information on potential release of contaminants. The study shows the importance of correlating SEM and TEM analyses as well as other pertinent techniques in order to understand more fully the mechanism of waste containment. (See also W91-06124) (Author's abstract)
W91-06141

PHYSICAL TESTING PROGRAM FOR STABILIZED METAL HYDROXIDE SLUDGES.
NTH Consultants, Exton, PA.
B. L. Forslund, L. J. Shekter Smith, and W. R. Bergstrom.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 214-226, 8 fig, 1 tab.

Descriptors: *Heavy metals, *Physical properties, *Sludge disposal, *Testing procedures, *Waste disposal, *Waste stabilization, On-site tests, Performance evaluation, Permeability, Sludge stabilization.

A proposed method of closing two Resource Conservation and Recovery Act surface impoundments containing metal hydroxide (F006) sludges involves stabilization and on-site disposal. A sample testing program was developed as part of an evaluation of processes offered by various firms interested in performing the stabilization. For this application, the stabilized material was to have sufficient strength to support construction and cover loads, low permeability, long-term durability, and low settlement under anticipated loads. Testing procedures developed are based on standard soil and soil-cement test methods to the extent possible. A falling-head test was used to determine the coefficient of permeability. Appropriate molds and specimen preparation procedures were sent to each firm with a sample of the raw sludge in order that the stabilized sludge specimens would be prepared in the same manner. In general, the specimen preparation procedures and test methods developed worked well for the stabilized sludge samples. The unconfined compressive strength test results were highly variable and ranged from 0.5 kg/sq km (100 lb/sq ft) to over 35 kg/sq cm (70,000 lb/sq ft. The compressibility under a load of 1.5 kg/sq com (3000 lb/sq ft) ranged from 0.5% to 5%. The permeability of the stabilized material was generally low. The specimens generally withstood more freeze/thaw cycles than wet/dry cycles; several of the specimens lost much of their strength and integrity upon saturation. No strong correlation between any of the physical properties was observed. However, specimens which include cement as an additive tended to fail at low strain, have higher unconfined comprehensive strength, and were less compressible. (See also W91-06124) (Lantz-PTT)
W91-06142

EXPERIMENTAL EVALUATION OF LIMITING FACTORS FOR LEACHING MECHANISM IN SOLIDIFIED HAZARDOUS WASTES.
Aquila Univ. (Italy). Dept. of Chemistry.
F. Medici, C. Merli, G. Scoccia, and R. Volpe.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 229-237, 4 fig, 4 tab, 18 ref.

Descriptors: *Hazardous wastes, *Laboratory methods, *Leaching, *Waste disposal, *Waste solidification, Cements, Data acquisition, Permeability.

Results of experimental tests show how the cumulative amount leached from different matrices depends essentially on the concentration of the immobilized toxic element, and on the matrix porosity. In particular, the experimentally observed relation of the matrix performance with porosity allows the formation of a hypothesis on the leaching mechanism of immobilized toxics. It is possible to assume that porosity and superficial macrocavity of the matrix constitute the controlling factors of the initial washing period, whereas capillary porosity controls the subsequent diffusive phase. It is also necessary to investigate the concomitant effect of the immobilized toxic concentration which should have a significant influence both on modalities of release and cumulative containment loss during two phases of release. During the experiments, immobilized toxic concentration and matrix capillary porosity were varied by lowering the water/cement ratio using superplasticizers and by adding micronized silica to the mixtures. It is also necessary to take into account the chemical-physical parameters which influence the leaching mechanism, that is, cement-ion reactions, ion size and ion solvation capacity. (See also W91-06124) (Lantz-PTT)
W91-06143

COLUMN LEACH TESTING OF PHENOL AND TRICHLOROETHYLENE STABILIZED/SOLIDIFIED WITH PORTLAND CEMENT.
New Hampshire Univ., Durham. Dept. of Civil Engineering.
B. Kolvites, and P. Bishop.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 238-250, 5 fig, 3 tab, 11 ref.

Descriptors: *Laboratory methods, *Leaching, *Phenols, *Portland cements, *Testing procedures, *Trichloroethylene, *Waste disposal, *Waste solidification, *Waste stabilization, Cements, Gas chromatography, Mathematical models, Organic wastes, Path of pollutants, Performance evaluation.

The ability of portland cement to stabilize/solidify organic wastes was evaluated by conducting column leaching tests on portland cement pastes containing phenol and trichlorethylene (TCE). Synthetic solidified waste was manufactured by mixing dilute aqueous solutions of phenol and TCE with portland type II cement at a 0.5 liquid to cement ratio. The liquid consisted of either 4000 mg/L phenol or 1100 mg/L TCE in purified water. The cement was cured for 3 days and 28 days at 100% humidity at room temperature, respectively. Thirty grams of particle approximately 5 to 10 mm in diameter were placed in an enclosed leaching apparatus. Purified water was pumped upward through the column at a rate of 0.08 to 0.18 ml/minute. Every 48 hours for eight days, samples of the leachate in the collection flask and samples of the vapor in the head spaces above the collection flask and leaching column were analyzed by gas chromatography. The concentration of phenol and TCE found in these samples were used to calculate the total mass of the organic compound which was released from the solidified waste during eight days of leaching. An empirical mathematical model was used to predict the long term leaching characteristics of the stabilized phenol waste. The leachability indexes calculated for phenol in cement paste cured 3 days and 28 days were 7.7 and 8.2 respectively. This index rates the relative mobility of the contaminant on a uniform scale that varies from 5 (very mobile) to 15 (immobile). Similar leachability indexes could not be calculated for cement paste containing TCE due to unquantified losses of TCE by volatilization prior to the start of the leach tests and suspected decomposition of TCE in the highly alkaline environment. Gas chromatograms of the TCE waste leachates contained unidentified peaks which were thought to represent the products of TCE decomposition. (See also W91-06124) (Author's abstract)
W91-06144

STUDY OF TRITIUM RELEASE FROM ENCAPSULATED TITANIUM TRITIDE ACCELERATOR TARGETS.
Purdue Univ., Lafayette, IN. School of Health Sciences.
For primary bibliographic entry see Field 5B.
W91-06145

METAL IMMOBILIZATION BY SOLIDIFICATION OF HYDROXIDE AND XANTHATE SLUDGES.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. M. Bricka, and D. O. Hill.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 257-272, 7 fig, 4 tab, 17 ref.

Descriptors: *Heavy metals, *Hydroxide sludge, *Sludge disposal, *Waste disposal, *Waste solidification, *Waste stabilization, *Xanthate sludge, Cements, Hazardous wastes, Organic compounds, Phenols, Portland cements.

An evaluation was conducted on the ability of cellulose and starch xanthate to immobilize heavy metals; results were compared with the metal immobilization capability of hydroxide precipitation. Solidified and unsolidified sludges resulting from starch xanthate, cellulose xanthate, and hydroxide precipitation processes were tested for their physical and chemical characteristics. Sludges were prepared using either cellulose xanthate, starch xanthate, or calcium, hydroxide to treat a synthetic waste solution containing four heavy metals (cadmium, chromium, nickel, and mercury) in a laboratory-scale study. Sludges were solidified with portland type I cement. Physical tests performed on the solidified and unsolidified xanthate and hydroxide sludges included unconfined compressive strength and the cone penetration tests. Chemical leaching characteristics of the unsolidified sludges were determined using the EPA's extraction procedure test and a serial graded batch extraction procedure. Results from the study indicated that the solidified materials reduced the concentration of metals in the leachate when compared to the unsolidified sludges. The solidified sludges also developed unconfined compressive strengths as high as 2000 kPa. (See also W91-06124) (Author's abstract)
W91-06146

USE OF ACTIVATED CHARCOAL AND TETRA-ALKYLAMMONIUM-SUBSTITUTED CLAYS IN CEMENT-BASED STABILIZATION/SOLIDIFICATION OF PHENOLS AND CHLORINATED PHENOLS.
Imperial Coll. of Science, Technology and Medicine, London (England). Dept. of Civil Engineering.,
T. S. Sheriff, C. J. Sollars, D. Montgomery, and R. Perry.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 273-286, 6 fig, 10 tab, 12 ref.

Descriptors: *Activated carbon, *Cements, *Clays, *Phenols, *Waste containment, *Waste disposal, *Waste solidification, *Waste stabilization, Adsorption, Asphalt, Bentonite, Gypsum, Organic wastes, Radioactive tracers, Radioactive wastes.

A number of cement-based fixation processes are available for the cost-effective stabilization of inorganic wastes, but these processes are not generally so effective for treating organic wastes or organic/inorganic mixtures. With a view to possible extension of such methods to organic wastes, the use of charcoal and tetra-alkylammonium-substituted clays as prestabilization adsorbents has been investigated. Charcoal is a well known adsorbent, while the use of the substituted clays exploits the hydrophobic properties of the alkyl groups to fix organic materials within the clay matrix. Wyoming bentonite substituted with hexadecyltrimethyl ammonium bromide and benzyldimethyltetradecylammoniom chloride were found to be very effective in adsorbing chlorinated phenols with adsorption capacities of 150 mg chlorinated phenol/gram of clay. There appears to be a clear trend between the chain length of alkylammonium ion in the exchanged clay and the ability of the clay to adsorb a particular phenolic compound. Activated charcoal was found to adsorb effectively 1980 mg of phenol or chlorinated phenols/gr of charcoal. The exchanged clays and charcoal, together with the respective adsorbed phenols, were incorporated into a number of cementitious matrices. Following hydration, leachability and physical strength measurements were carried out and the results were used to make a preliminary assessment of the longer-term potential of clay and charcoal in stabilization/solidification applications. (See also W91-06124) (Author's abstract)
W91-06147

SOLUBILITY AND STABILITY OF INORGANIC IODIDES: CANDIDATE WASTE FORMS FOR IODINE-129.
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
P. Taylor, V. J. Lopata, D. D. Wood, and H. Yacyshyn.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 287-301, 6 fig, 43 ref.

Descriptors: *Iodides, *Iodine radioisotopes, *Radioactive waste disposal, *Solubility, *Waste disposal, *Waste stabilization, *Waste treatment, Bismuth oxyiodide, Halides, Inorganic compounds, Radioactive wastes, Silver iodide, Waste management.

129-Iodine and 14-carbon are of lesser importance than many other radionuclides in nuclear waste management because of their relatively low radiotoxicity. Their safe immobilization and disposal is a significant challenge because their chemical properties are quite different from most other components of nuclear fuel waste. Thermodynamically defensible inorganic waste forms have been sought for both of these radioisotopes. The stability and solubility of inorganic iodides have been investigated as they relate to the selection of a waste form for 129-iodine. The best candidates appear to be silver iodide (AgI) either alone or in combination with silver chloride (AgCl), and a combination of Bi5O7I and Bi2O2. Neither is completely satisfactory. The principal drawback of AgI is its relative ease of reduction. High chloride concentrations also increase the solubility of AgI, but it is insensitive to carbonate. The main disadvantage of bismuth oxyiodide is its susceptibility to displacement reactions with dissolved chloride and carbonate. In addition, it is unstable under strongly reducing conditions. (See also W91-06124) (Author's abstract)
W91-06148

LEACHING-INDUCED CONCENTRATION PROFILES IN THE SOLID PHASE OF CEMENT.
Brookhaven National Lab., Upton, NY. Nuclear Waste Research Group.
M. Fuhrmann, and P. Colombo.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 302-314, 10 fig, 2 tab, 9 ref.

Descriptors: *Cements, *Leaching, *Materials testing, *Waste disposal, *Waste solidification, *Waste stabilization, Cesium radioisotopes, Hazardous waste disposal, Path of pollutants, Performance evaluation, Portland cements, Potassium, Radioactive wastes.

Analysis of the solid phase of portland cement specimens by energy dispersive x-ray spectrometry, before and after leaching, provided elemental profiles within the cement. Releases of potassium were calculated from the solid phase profiles and were compared with releases determined from leachate analyses of potassium and 137-cesium. The fraction of potassium released in the leachate was closely correlated to that of 137-cesium under varying time and temperature conditions, despite the different manner in which each was originally contained in the cement. Agreement was obtained among potassium releases as determined from the solid potassium in the leachate, and 137-cesium in the leachate. These correlations allowed the use of potassium as an analog for 137-cesium in cement. Profiles of potassium in the solid showed varying degrees of depletion. A specimen, sectioned immediately after leaching for 471 days, contained no observable potassium to 9 mm depth from the specimen surface. From 9 mm to the center of the specimen, an apparently linear increase in concentration was observed. Specimens which had been air dried prior to sectioning had profiles that were produced by evaporative transport of dissolved species toward the surface. Carbonation of the surface appears to have retarded the migration of the dissolved material. This prevented it from reaching the outer edge and resulted in increased potassium concentrations several millimeters inside the surface. (See also W91-06124) (Author's abstract)
W91-06149

STRATEGY FOR MANAGEMENT OF MIXED WASTES AT THE WEST VALLEY DEMONSTRATION PROJECT.
Department of Energy, West Valley, NY. West Valley Demonstration Project.
J. P. Englert, C. J. Roberts, and E. E. Smeltzer.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 317-329, 4 fig, 4 tab, 29 ref.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Radioactive waste disposal, *Waste disposal, *Waste management, *Waste stabilization, *West Valley Demonstration Project, New York, Radioactive wastes, Regulations.

Mixed-waste management involves compliance with dual regulations promulgated by the EPA and either the Nuclear Regulatory Commission (NRC) or the Department of Energy (DOE). Identification for the regulatory requirements and resolution of potential inconsistencies between the regulations are challenges facing mixed waste generators and treatment, storage and disposal facilities (TSDF's) as they develop compliance strategies. At the West Valley Demonstration project (WVDP) in New York, several exclusion options are being exercised for characteristic mixed waste streams. A totally enclosed treatment exemption is being pursued for cemented extracted salt solutions. A combination of neutralization and treatment in accumulation tanks and containers is used for smaller less radioactive mixed waste streams. The objective of this strategy is to eliminate the hazardous characteristics, thereby allowing the waste to be stored and disposed of solely as radioactive waste. If listed mixed wastes are encountered, the project will have to revise this strategy to provide for mixed waste treatment, storage and disposal in accordance with both the radioactive and hazardous waste regulations. (See also W91-06124) (Lantz-PTT)
W91-06150

LEACHING LOW-LEVEL RADIOACTIVE WASTE IN SIMULATED DISPOSAL CONDITIONS.
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 5B.
W91-06151

STABILIZATION OF MIXED WASTE AT THE IDAHO NATIONAL ENGINEERING LABORATORY.
Idaho National Engineering Lab., Idaho Falls. Waste Engineering Development Unit.
A. M. Boehmer, R. L. Gillins, and M. M. Larsen.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 343-357, 6 tab, 5 ref. DOE Contract No. DE-AC07-76-ID01570.

Descriptors: *Hazardous wastes, *Idaho National Engineering Laboratory, *Laboratory methods, *Radioactive waste disposal, *Waste disposal, *Waste solidification, *Waste stabilization, *Waste treatment, Fly ash, Landfills, Radioactive wastes.

A drum-scale test program was conducted to verify that laboratory-scale results for treating hazardous and mixed wastes could be successfully adapted into a production operation. The primary goal of drum-scale stabilization development was to verify that the successful results obtained in the laboratory-scale program could be adapted into a production scale operation. The result of the production scale will be a stabilized waste monolith that contains no free liquids, no leachable metal levels in excess of EPA limits, and can be disposed of as a general or low level radioactive waste. The objectives set for meeting this goal were: (1) verification of the laboratory-scale binder-to-waste ratios (recipes) at a drum-scale level, (2) development of mixing and sampling methods to ensure and verify homogeneity of the mixture in the drum, (3) verification that the monolith leachable metal levels are below EPA toxicity leaching criteria, and (4) development of procedures for production scale solidification. Results obtained from four drums that were processed show, through both analytical and statistical evaluations, that the monolith resulting from the solidification process does not contain leachable toxic metal levels in excess of EPA limits and can be disposed of as a low level radioactive waste. (See also W91-06124) (Lantz-PTT)
W91-06152

INFLUENCE OF HYDROLOGIC FACTORS ON LEACHING OF SOLIDIFIED LOW-LEVEL WASTE FORMS AT AN ARID-SITE FIELD-SCALE LYSIMETER FACILITY.
Battelle Pacific Northwest Labs., Richland, WA.
T. L. Jones, and R. L. Skaggs.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 358-380, 14 fig, 2 tab, 9 ref. DOE Contract No. DE-AC06-76RL0 1830.

Descriptors: *Arid lands, *Geohydrology, *Hanford, *Leaching, *Path of pollutants, *Radioactive waste disposal, *Radioactive wastes, *Waste disposal, *Waste solidification, *Waste stabilization, *Water pollution sources, Cobalt radioisotopes, Drainage, Field tests, Lysimeters, Portland cements, Seasonal variation, Soil water, Tritium, Washington.

The release of contaminants from solidified low-level waste forms is being studied in a field lysimeter facility at the Hanford Site in southeastern Washington State. The lysimeter facility, constructed in 1984, consists of ten 3 m deep by 1.8 m diameter steel caissons surrounding a 4 m deep central instrument caisson. Each lysimeter contains one field-scale waste form (210-L barrel), obtained from a commercial power reactor. Solidification agents being tested include masonry cement, Portland III cement, Dow polymer, and bitumen. Most of the precipitation at the Hanford Site arrives as winter snow; this contributes to a strong seasonal pattern in water storage and drainage observed in the lysimeters. This seasonal pattern in winter storage corresponds to an annual range in the volumetric soil water content of 11% in late winter to 7% in the late summer and early fall. Annual changes in drainage rates cause pore water velocities to vary by nearly two orders of magnitude, from approximately 4 cm/wk in early spring to less than 0.01 cm/week in early fall. Measurable quantities of tritium and Co60 are being collected in lysimeter drainage water. Approximately 30% of the original tritium inventory has been leached from the only two waste forms containing tritium. Co60 is contained in all waste form samples and is consistently being leached from five lysimeters. Total Co60 collected from each of the five lysimeters varies, but in each case is less than 0.1% of the original cobalt inventory of the waste sample. (See also W91-06124) (Author's abstract)
W91-06153

EXPERIENCE ACQUIRED IN THE FIELD OF LONG-TERM LEACHING TESTS ON BLOCKS OF RADIOACTIVE WASTE.
CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
J. C. Nomine, and A. Billon.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 381-391, 5 fig, 6 tab, 8 ref.

Descriptors: *Field tests, *Leaching, *Path of pollutants, *Radioactive wastes, *Waste disposal, France, Geochemistry, Ion transport, Radionuclides, Waste containment.

Long-term leaching tests on full size radioactive blocks have been undertaken since 1979 in the leaching facility of the Nuclear Research Center of Saclay. The aims of the tests are: the assessment of the release of radionucleotides into the biosphere; measurements of ion transfer between the blocks and the environment; and an understanding of the transfer mechanisms. These full-scale tests lead to the following conclusions: (1) In spite of some difficulties encountered during the experiments, it has been possible to make a judgement on the quality of the package by establishing the more exhaustive balance of the total activity released, especially with alpha-emitters; (2) Appraisals of the post-leached packages are very important because they enhance knowledge of their behavior under leaching tests with realistic conditions; and (3) Extrapolation of leaching results from small laboratory samples to full size blocks is not always easy. Long-term, full-scale leaching tests will be continued. (See also W91-06124) (Lantz-PTT)
W91-06154

LARGE-SCALE DEMONSTRATION OF LOW-LEVEL WASTE SOLIDIFICATION IN SALTSTONE.
Du Pont de Nemours (E.I.) and Co., Philadelphia, PA. Marshall Labs.
P. F. McIntyre, S. B. Oblath, and E. L. Wilhite.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 392-403, 5 fig, 3 tab, 9 ref. DOE Contract No. DE-AC09-76SR00001.

Descriptors: *Leaching, *Lysimeters, *Path of pollutants, *Radioactive waste disposal, *Saltstone, *Waste disposal, *Waste solidification, *Waste stabilization, Demonstration projects, Mathematical models, Monitoring, Nitrates, Nuclear powerplants, Radioactive wastes, Soil water, Technetium radioisotopes.

Saltstone lysimeters are a large-scale demonstration of a disposal concept for decontaminated salt solutions resulting from the in-tank processing of defense wastes. The lysimeter experiment has provided data on the leaching behavior of large saltstone monoliths under realistic field conditions. The results also will be used to compare the effect of capping the waste form on containment release. Three saltstone lysimeters were installed in December 1983 and January 1984, each containing a buried monolith formed from 9500 L of decontaminated salt solution solidified with a blended cement. The decontaminated salt solution was produced using actual Savannah River Plant waste. One lysimeter has a gravel cap and another has a clay cap placed over the buried monolith. The monolith in the third lysimeter is uncapped. Each lysimeter has provisions to collect leachate from a sump below the buried monolith, and soil moisture samplers for gathering samples adjacent to the waste form. Biweekly monitoring of sump leachate from all three lysimeters has continued on a routine basis for approximately three years. The uncapped lysimeter has shown the highest levels of nitrate and Tc90 release. The gravel and clay capped lysimeters have shown levels equivalent to or slightly higher than background rainwater levels. (See also W91-06124) (Author's abstract)
W91-06155

FIELD TESTING OF WASTE FORMS USING LYSIMETERS.
Idaho National Engineering Lab., Idaho Falls. Biotechnology and Waste Management Programs.
R. D. Rogers, J. W. McDonnel, E. C. Davis, and M. W. Findley.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 404-417, 9 fig, 7 tab, 6 ref.

Descriptors: *Field tests, *Leachates, *Lysimeters, *Path of pollutants, *Radioactive wastes, *Waste disposal, *Waste solidification, *Waste stabilization, Beta radiation, Cements, Databases, Filters, Gamma radiation, Ion exchange resins, Radionuclides, Rainfall, Strontium, Temperature.

Solidified ion exchange resin materials from EPICORE-II prefilters used in the cleanup of the Three Mile Island Nuclear Power Station, are being field tested to develop a low-level waste database and to obtain information on survivability of waste forms composed of ion exchange media loaded with radionucleotides and solidified in matrices of cement and Dow polymer. Field testing occurred over 17 months. Wind speed, air temperature, relative humidity, and rainfall are recorded over a 12 month period by the data acquisition and storage (DAS) system for the Argonne National Laboratory (ANL) and the Oak Ridge National Laboratory (ORNL) sites. Rainfall appeared higher than normal while there were few days with temperatures of 0 degrees C. Water samples were collected from the leachate on five occasions. The first two times water samples were analyzed only for gamma producing nuclides. The last three water samples were analyzed for gamma and beta producing nucleotide Sr. Gamma producing nucleotides were not found in the first two samples. The concentration of Sr in the ORNL lysimeter leachate was almost two orders of magnitude higher than the ANL samples. (See also W91-06124) (Lantz-PTT)

W91-06156

IN SITU GROUTING OF SHALLOW LAND-FILL RADIOACTIVE WASTE TRENCHES.
Oak Ridge National Lab., TN. Chemical Technology Div.
R. D. Spence, and T. Tamura.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 418-429, 5 fig, 3 tab, 1 ref. DOE Contract No. DE-AC05-84OR21400.

Descriptors: *Grouting, *Landfills, *Radioactive waste disposal, *Waste disposal, *Waste solidification, *Water pollution prevention, Costs, Leaching, Monitoring, Observation wells, Permeability.

A backfill trench containing low-level radioactive waste was grouted with a newly developed cement-fly ash-bentonite particulate grout. The accessible void volume of the waste zone was estimated to be 20% or 28 cu m, but 30.6 cu m of grout was injected under pressure into the trench. Part of the grout forced a path outside the trench. Much of the trench was grouted from only a few holes, about 80% from five holes. The grout cost $55/cu m, and it took 1220 man-hours and eleven days to completely grout the trench. The total cost of renting the grouting equipment for this job was $3449. Preliminary assessment indicates successful grouting of accessible voids and improved resistance to water intrusion; the water permeation into the trench from monitoring wells was reduced by two orders of magnitude. Only the ongoing evaluation over several years will determine if the grouting prevents trench subsidence and reduce radionuclide migration. The site characterization and follow-up evaluation costs should be similar for different alternatives. (See also W91-06124) (Lantz-PTT)
W91-06157

HAZARDOUS AND INDUSTRIAL SOLID WASTE MINIMIZATION PRACTICES.
STP 1043. ASTM, Philadelphia, PA. 1989. 214p. Edited by R. A. Conway, John H. Frick, David J. Warner, Carlton C. Wiles, and E. Joseph Duckett.

Descriptors: *Symposium, *Waste disposal, *Waste reduction, *Waste treatment, Conferences, Oil wastes, Solvents, Waste management, Waste recovery, Waste utilization.

Waste minimization has been growing in popularity and is being approached as the last frontier of hope in dealing properly with the generation of waste. In order to explore the benefits of standardization on this front, members of ASTM organized a new subcommittee on waste minimization. In addition, a symposium was organized by Committees D34 on Waste Disposal and E38 on Resource Recovery to stimulate investigation into the standards development process and to encourage further dialogue and expanded implementation of waste minimization practices. This symposium, the Eighth Symposium on Hazardous and Industrial Solid Waste, presented information on managerial practices, auditing techniques, and specific practices used by industry and government activities. The collection of 17 papers has been grouped into five major categories as follows: general managerial practices, waste minimization audits, solvent recovery, used oil recovery, and miscellaneous separation and utilization practices. (See W91-06159 thru W91-06175) (Lantz-PTT)
W91-06158

HAZARDOUS WASTE REDUCTION EFFORTS IN THE DEPARTMENT OF THE ARMY.
Office of the Assistant Chief of Engineers (Army), Washington, DC.
For primary bibliographic entry see Field 5D.
W91-06159

WASTE MINIMIZATION PROGRAM AT THE FEED MATERIALS PRODUCTION CENTER.
Westinghouse Materials Co. of Ohio, Cincinnati.
J. E. Blasdel, M. E. Crotzer, R. L. Gardner, T. R. Kato, and C. N. Spradlin.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 17-28, 11 fig, 5 ref.

Descriptors: *Feed Materials Production Center, *Radioactive wastes, *Waste management, *Waste reduction, Recycling, Uranium, Waste disposal, Waste recovery.

A waste minimization program is being implemented at the Feed Materials Production Center, (a Department of Energy (DOE) facility that produces high purity metallic uranium for the U.S. defense program) to reduce the generation of uranium-contaminated wastes and to comply with existing and forthcoming regulations. Procedures and plans are described that deal with the minimization of process and nonprocess trash, contaminated wood and metals, used metal drums, and major process wastes such as contaminated magnesium fluoride and neutralized raffinate. The waste minimization techniques used include segregation, source reduction, volume reduction, material substitution and waste/product recycling. The importance of training, communication, and incentives are emphasized. (See also W91-06158) (Author's abstract)
W91-06160

MINIMIZING WASTE BY CHARGING THE GENERATOR.
Oak Ridge National Lab., TN. Chemical Technology Div.
J. B. Berry, and F. J. Homan.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 29-37, 2 fig, 2 tab, 6 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Cost allocation, *Radioactive waste disposal, *Waste disposal, *Waste management, *Waste reduction, Costs, Economic aspects.

The Oak Ridge National Laboratory, a multipurpose research and development facility, has implemented a program to include the cost of waste management in product costs. The following steps are being used: (1) planning and implementation tailored to institutional constraints; (2) methods for conflict resolution; and (3) administrative structures that place responsibility for minimizing waste on the generators. Changes in waste disposal practices required to meet regulatory requirements increase the cost of waste management and are reflected in the rate structure. Rate structure and changes in waste disposal practices including radioactive disposal are compared. Rates were found to be dependent on the type of waste handled, compliance with waste acceptance criteria, processing steps required for treatment, and disposal requirements. (See also W91-06158) (Author's abstract)
W91-06161

WASTE REDUCTION AUDITS: MATCHING TYPES TO STAGES.
Office of Technology Assessment, Washington, DC.
J. S. Hirschhorn, and K. U. Oldenburg.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 41-47, 5 ref.

Descriptors: *Surveys, *Waste management, *Waste reduction, Data acquisition, Hazardous wastes, Manuals.

Although technology itself is not a major obstacle to achieving maximum hazardous waste reduction, many other factors can limit industrial waste reduction. The chief way that obstacles to waste reduction are identified and overcome is through the use of waste reduction audits. It is necessary, however, to have a close match between the specific stage of waste reduction and the type of waste reduction audit used. For the first two stages of waste reduction, the common sense and information driven stages--a very simple self-audit check list is efficient. For the third and fourth stages of waste reduction, more elaborate, time consuming, and costly audits are appropriate and the use of outside consultants may be effective. Waste generators should make use of increasing numbers of government waste reduction programs, which provide information, audit manuals, and sometimes free on-site technical assistance. (See also W91-06158) (Author's abstract)
W91-06162

WASTE MINIMIZATION AUDITS AT INDUSTRIAL AND DOD INSTALLATIONS.
Versar, Inc., Springfield, VA.
M. Drabkin, E. Rissmann, P. Sylvestri, and H. Freeman.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 48-61, 7 fig, 4 tab, 6 ref.

Descriptors: *Hazardous wastes, *Industrial wastes, *Military reservations, *Surveys, *Waste management, *Waste reduction, *Waste reduction audits, Case studies, Data acquisition, Economic aspects, Waste disposal.

The EPA is encouraging hazardous waste generators to develop programs to reduce the generation of hazardous waste. To encourage such programs the Agency's Hazardous Waste Engineering Research Laboratory is supporting the development and evaluation of a model hazardous waste minimization audit (WMA) procedure. The eight sequential steps are: (1) preparation for the audit; (2) host site pre-audit visit; (3) waste stream selection; (4) host site waste minimization audit visit; (5) generation of waste minimization (WM) options; (6) preliminary WM options evaluation (including preparation of preliminary cost estimates) and ranking of options in three categories (effectiveness, extent of current use, and potential for future application); (7) presentation, discussion, and joint review of options with plant personnel; and (8) final report preparation and presentation to host site management. This procedure was tested in a number of industrial and Department of Defense (DoD) facilities during 1986 and 1987. Two of these tests, one private industry (a mercury cell chloralkali plant) and one DoD (a paint stripping facility) are described at length. (See also W91-06158) (Lantz-PTT)
W91-06163

HAZARDOUS WASTE MINIMIZATION AUDITS: STRATEGY AND METHODOLOGY.
Environmental Science and Engineering, Inc., Gainesville, FL.
M. E. Resch.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 62-70, 6 ref.

Descriptors: *Data acquisition, *Hazardous wastes, *Surveys, *Waste management, *Waste reduction audits, Industrial wastes, Waste treatment.

Hazardous waste minimization audits have been performed at numerous industrialized facilities. The strategies and methodologies used in these minimization audits are detailed and thorough, and they efficiently utilize the manpower of the audit team. These auditing procedures can be used either by personnel contracted to perform minimization audits at client facilities, or by in-plant personnel performing minimization 'self audits.' The waste minimization audit consists of six principal phases: (1) preparations made before the site visit; (2) onsite information gathering; (3) identification of minimization opportunities for specific wastes; (4) setting of priorities for minimization opportunities for specific wastes; (5) development of plant-wide minimization recommendations; and (6) recommendations for the management of wastes that cannot be further minimized. (See also W91-06158) (Author's abstract)
W91-06164

RESULTS OF FIELD SAMPLING PROGRAMS CONDUCTED AT WASTE SOLVENT TREATMENT AND RECYCLING FACILITIES.
Alliance Technologies Corp., Bedford, MA.

D. R. Roeck, and N. Pangaro.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 73-79, 2 fig, 9 tab, 5 ref.

Descriptors: *Field tests, *Hazardous waste disposal, *Recycling, *Solvents, *Waste disposal, *Waste treatment, Chemical analysis, Distillation, Evaporation, Land disposal, Metals.

As required by the 1984 Hazardous and Solid Waste Act, EPA began a program to conduct in-depth evaluations of all hazardous wastes to determine applicable restrictions on some or all forms of land disposal. Three field sampling programs were conducted to assess the performance capabilities of offsite solvent recycling facilities. These field programs resulted in the compilation of extensive data on the operation and performance capability of such waste treatment processes as steam distillation, thin-film evaporation, and still-bottom processing. Samples were taken of all waste feed, still bottoms, and distillate product streams, and analyzed for inorganic and organic constituents to satisfy EPA criteria. Analytical results were evaluated to determine the fate of various metals and other solvent constituents among input and effluent streams. In general, these field programs have shown that the solvent recycling processes evaluated are very effective for the production of high quality distillate product streams suitable for a variety of uses. In addition, metal contaminants detected in waste feed streams were virtually all transferred to the still-bottoms streams, which were mostly disposed of by offsite fuel supplement users (i.e., asphalt kilns and blast furnaces). (See also W91-06158) (Lantz-PTT)
W91-06165

METHODS FOR MONITORING SOLVENT CONDITION AND MAXIMIZING ITS UTILIZATION.
Air Force Engineering and Services Center, Tyndall AFB, FL.
S. B. Joshi, B. A. Donahue, A. R. Tarrer, J. A. Guin, and M. A. Rahman.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 80-103, 17 fig, 6 tab, 22 ref.

Descriptors: *Chemical analysis, *Hazardous wastes, *Quality control, *Solvents, *Testing procedures, *Waste reduction, *Waste treatment, Conductivity, Distillation, Field tests, Gas chromatography, Laboratory methods, Monitoring, Physical properties, Specific gravity, Spectrometry, Tetrachloroethylene, Trichloroethane, Trichloroethylene, Viscosity.

Simple tests were evaluated which are to be used as criteria for determining the condition of cold dipping (Stoddard solvent), vapor degreasing (chlorinated solvents), and precision cleaning solvents (Freon-113 and isopropanol), and for identifying when a solvent should be changed, thereby extending its usage life cycle. The use of these tests to monitor the quality of reclaimed solvent was also explored. Several physico-chemical solvent properties were selected on the basis of sensitivity to solvent contamination, and the reliability and simplicity of the methodology for measuring these properties. Visible absorbance spectrometry was the most reliably measured property, followed by specific gravity, viscosity, and electrical conductivity. The major inhibitors present in trichloroethylene (TCE), tetrachlororethylene (PCE), and 1,1,1-trichloroethane (TCA) were identified using gas chromatography/mass spectrometry. These inhibitors can be classified as antioxidants, acid acceptors, and metal stabilizers. The inhibitor concentrations were monitored with usage time. Batch kinetic studies show that the reactions between the acid acceptors (butylene oxide, cyclohexene oxide, and epichlorohydrin) and hydrochloric acid, and between the metal stabilizers (1,4-dioxane and 1,3-dioxolane) and aluminum chloride were each second-order overall when PCE was used as a solvent. A simple test was also devised to determine the metal stabilizer concentration in a solvent. Solvent reclamation by batch distillation is a viable option for significantly reducing solvent replacement and disposal costs. (See also W91-06158) (Lantz-PTT)
W91-06166

APPLICATION OF A MOBILE SOLVENT RECOVERY PROCESS TO MINIMIZE HAZARDOUS WASTE.
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W91-06167

MINIMIZING WASTE OIL DISPOSAL.
Earth Technology Corp., Alexandria, VA.
F. E. Godoy, and M. H. Savage.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 115-122, 3 tab, 13 ref.

Descriptors: *Hazardous wastes, *Oil wastes, *Recycling, *Waste disposal, *Waste recovery, *Waste reduction, Case studies, Military reservations, On-site treatment, Waste management.

Waste oils fall into several categories including lubricating oils, hydraulic fluids, metal working fluids, and transformer oils. Used oil is generated through a variety of activities including vehicle maintenance and equipment maintenance (for example, refrigeration equipment, compressors, and turbines). With several states currently regulating used oil as a hazardous waste and with federal regulations being considered to regulate disposal more stringently, minimizing the quantity of waste oil disposed can have both environmental and economic benefits. Proper management practices, which eliminate contamination of used oils with other wastes, make used oil more amenable to reuse for its original purpose or for reuse as a fuel. In general, waste oil minimization alternatives are: (1) on-site recovery of waste oils; (2) on-site use as fuel; (3) off-site disposal through fuel blending; (4) off-site recycling; and (5) on-site techniques to minimize the volume of waste oils. Case studies are presented of ten military installations, illustrating the utilization of waste oils as fuel, and recycling waste machine coolants. (See also W91-06158) (Lantz-PTT)
W91-06168

DEMETALLATION OF USED OIL TO FACILITATE ITS UTILIZATION AS A FUEL.
Auburn Univ., AL. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W91-06169

WASTE OIL MANAGEMENT FOR A SMALL QUANTITY GENERATOR.
Fruehauf Corp., Detroit, MI.
T. H. DeFouw, B. Verdegan, and R. Zoch.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 143-150, 2 fig, 3 tab, 12 ref.

Descriptors: *Case studies, *Oil recovery, *Oil wastes, *Recycling, *Waste management, *Waste recovery, *Waste treatment, Costs, Industrial wastes, Oil-water interfaces, Separation techniques.

Government regulations concerning 'used oil', underground storage tanks, and hazardous waste have had a significant impact on industry. Waste oil that is determined to be a hazardous waste is costly to dispose of. A proper 'used oil' management plan that prevents inadvertent contamination with hazardous wastes (that is, mixing with solvents, paint thinners) will lower a facility's disposal costs. The paper focuses on one small quantity generator's used oil management system that minimizes indiscriminate oil mixing and promotes oil reuse and recycling; this system could be installed and operated at any facility. Ship bilgewater oil has been a problem in the maritime industry for a number of years. A maritime oil/water separation unit was installed at a transportation service and repair facility as part of the tanker cleaning operation. The cleaning operation is as follows: steam and hot water are passed through a tanker to remove residual oils and vapors. The oil/water mixture is collected and processed through a treatment system to separate the oil and water. Six field tests were made using different type oils and oil mixtures. The tests indicate that water discharged after processing contained < 15-ppm oil and met discharge requirements for the local sanitary sewer system. The separated oil was collected by type into 208 L (55 gal) drums. Several drums of separated oil were reused for fuel in the facilities transportation and space heating equipment. The remaining oil was returned to the customer for reuse. By recycling the oil, the EPA does not consider the facility a waste generator. The recycled oil provides an additional fuel source thereby lowering the facility's operating costs. Oil collection in drums eliminates the need for an underground storage tank and compliance with tank regulations. The system required less capital investment and installation than standard gravity separation systems. The equipment was located completely above ground and could be set up for fully automatic or manual operation. (See also W91-06158) (Lantz-PTT)
W91-06170

EFFICIENCIES IN WASTE PROCESSING.
University of South Florida, Tampa. Dept. of Civil Engineering and Mechanics.
For primary bibliographic entry see Field 5D.
W91-06171

HAZARDOUS WASTE VOLUME REDUCTION RESEARCH IN THE U.S. ENVIRONMENTAL PROTECTION AGENCY.
Environmental Protection Agency, Cincinnati, OH. Hazardous Waste Engineering Research Lab.
J. F. Martin, M. J. Stutsman, and E. Grossman.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 163-171, 2 fig, 2 tab, 9 ref.

Descriptors: *Hazardous wastes, *Research priorities, *Waste management, *Waste reduction, *Waste treatment, Adsorption, Benzene, Clays, Costs, Detoxification, Hydrogen ion concentration, Metals, Organic compounds, Pentachlorophenol, Physical treatment, Separation techniques, Sludge treatment, Trichlorophenol, Waste recovery.

Reducing the volume of hazardous waste may not provide relief from the toxic nature of the compound, but it does provide a significant benefit in reducing transportation, treatment, and disposal costs. The EPA's Hazardous Waste Engineering Research Laboratory supports extramural studies in waste detoxification, concentration and recovery, and minimization. A phosphate precipitation process currently under evaluation is felt to be effective in selectively removing metals from metal finishing sludge materials. Research also indicates that sodium smectite clay, an abundant natural material, can be modified in structure so that it has excellent adsorptive properties for removing compounds like benzene, trichlorophenol, and pentachlorophenol from aqueous solutions. The separation of dilute hazardous organics using thin-film, composite, aromatic polyamide membranes also appears to be advantageous in terms of high solute separation at low pressures (1 to 2 MPa) and broad pH operating ranges (pH 2 to 12). (See also W91-06158) (Author's abstract)
W91-06172

UTILIZATION OF ASH PRODUCTS FROM COMBUSTION OF SHREDDED SOLID WASTE.
Energy Answers Corp., Albany, NY.
R. F. Mahoney, and J. F. Mullen.
IN: Hazardous and Industrial Solid Waste Minimization Practices. STP 1043. ASTM, Philadelphia, PA. 1989. p 196-204, 1 fig, 4 tab, 9 ref.

Descriptors: *Fly ash, *Hazardous wastes, *Solid wastes, *Waste recovery, *Waste treatment, Dioxins, Heavy metals, Hydrochloric acid, Municipal wastes, Recycling, Sulfur dioxide.

Two streams of ash result from the combustion of municipal solid waste: fly ash and bottom ash. Studies have consistently found fly ash to contain levels of heavy metals, dioxins, acid gas constituents and other pollutants in excess of regulatory standards, while the bottom ash stream is generally within acceptable limits for those same pollutants. Research and development activities which focused on the reuse of bottom ash as a lightweight aggregate, have shown very promising opportunities for recycling a portion of this waste stream. The industry approach thus far has been to combine the two streams to assure that the fly ash is not classified as a hazardous or toxic material under present and proposed Federal EPA standards. However, with the increasing regulatory demand for the removal of hydrochloric acid and sulfur dioxide, the technology for the removal of potentially harmful substances from waste combustion fuel gases will improve, and more heavy metals, dioxins, and other hazardous materials will be concentrated in fly ash, rendering it less useful in recycling applications. It is suggested that the two separate ash streams can no longer reasonably by considered one and should be analyzed and treated separately. This will increase and enhance the opportunity to recycle the bottom ash (75%) and to focus on a reduced quantity of fly ash material (25%) for fixation and disposal. Such action would conform to the principles of, and the present regulatory trend toward, waste minimization. (See also W91-06158) (Author's abstract)
W91-06175

ODOUR AND AMMONIA EMISSIONS FOLLOWING THE SPREADING OF AEROBICALLY-TREATED PIG SLURRY ON GRASSLAND.
AFRC Inst. of Grassland and Animal Production, Hurley (England).
B. F. Pain, B. R. Phillips, C. R. Clarkson, T. H. Misselbrook, and Y. J. Rees.
Biological Wastes BIWAED, Vol. 34, No. 2, p 149-160, 1990. 1 fig, 3 tab, 23 ref.

Descriptors: *Aerobic treatment, *Animal wastes, *Farm wastes, *Hogs, *Land disposal, *Odor control, *Waste disposal, Ammonia, Hydrogen ion concentration, Slurries.

Following mechanical separation of pig slurry, two pilot-scale reactors were used to treat aerobically the liquid fraction with a 4-day residence time and an operating temperature of 35 C. In one reactor, redox potential was controlled to between -145 and -45 millivolts Ecal and, in the other, dissolved oxygen to between 1-2 mg O2/L. Unseparated and separated slurries and two aerobically-treated slurries were applied to grassland plots at 8 L/square m and a system of small wind tunnels were used in the collection of odorous air samples and in the measurement of ammonia volatilization. Odor measurements were conducted by dynamic dilution olfactometry. Both aerobic treatments reduced the total odor emission over 52 hours by 55% compared with unseparated, untreated slurry, while separation alone gave a 26% reduction. However, during the first 2 hours after spreading, when the rate of emission was highest, odor emission was 41.2 odor units/second for unseparated slurry, 29.8 odor units/second for separated slurry and 21.6 odor units/second for redox potential-treated slurry, but only 4.0 odor units/second for dissolved oxygen-treated slurry. Aerobic treatment also reduced odor intensity and odor offensiveness. Both aerobic treatment followed by storage increased slurry pH, which led to an increase in the total loss of N through ammonia volatilization after spreading on land. (Author's abstract)
W91-06226

URBAN STORMWATER INFILTRATION: PURPOSES, IMPLEMENTATION, RESULTS.
Georgia Univ., Athens. School of Environmental Design.
B. K. Ferguson.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 605-609, November/December 1990. 5 fig, 13 ref.

Descriptors: *Artificial recharge, *Infiltration, *Storm runoff, *Storm water management, *Urban runoff, *Wastewater disposal, Rainfall infiltration, Storm drains, Storm seepage, Storm water, Surface detention, Water level.

The 1986 amendments to the Water Quality Act put the federal government into the stormwater regulation business; the U.S. EPA is now in the process of implementing regulations for its control. Development both aggravates the hazards associated with storm flows and injures the resources supported by low flows. Stormwater management must address base flows as well as peak flows. One promising approach to solving stormwater problems is to use on-site soil as a mediator of stormwater flows and quality. Infiltration means soaking water in to the soil. It involves collecting stormwater in closed basins where it is stored while filtering into the surrounding soil. Unlike a detention basin, an infiltration basin has no regular surface outlet. An open, dry basin, emptying entirely after a storm and remaining dry during smaller background flows, can be used in a development that has sufficient open space and a level area of grass or earth. A permanent pool with a relatively stable water level can be formed where a basin's floor is excavated to the groundwater table. An ephemeral basin has a fluctuating water level or only occasional standing water. Such a regime is desirable in open infiltration basins where native wetland plants are adapted to fluctuating water levels. Underground basins can isolate perceived nuisances from the surface environment; the surface then can be reclaimed for aesthetic or economic uses. Other means of creating subsurface cavities for storing stormwater are large perforated pipes and specially manufactured cylindrical chambers. Basins can be designed and constructed so that water will infiltrate even in slowly permeable soils. These basins will control peak flows and need not generate nuisances of mud, mosquitoes, or snakes. They can be elegantly adapted into site plans for urban developments. (Mertz-PTT)
W91-06228

SWEET CORN YIELD AND TISSUE METAL CONCENTRATIONS AFTER SEVEN YEARS OF SEWAGE SLUDGE APPLICATIONS.
Oregon State Univ., Corvallis. Agricultural Experiment Station.
G. L. Kiemnec, D. D. Hemphill, M. Hickey, T. L. Jackson, and V. V. Volk.
Journal of Production Agriculture, Vol. 3, No. 2, p 232-237, 1990. 5 tab, 28 ref.

Descriptors: *Agricultural engineering, *Bioaccumulation, *Corn, *Heavy metals, *Land application, *Sludge utilization, *Trace metals, Cadmium, Fertilizers, Leaves, Lime, Manganese, Oregon, Plant tissues, Sulfates, Zinc.

The amount of sewage sludge applied to land is limited by Environmental Protection Agency (EPA) recommendations regarding soil pH and cation exchange capacity and the amount of Cd applied. Sewage sludges from Salem, Portland, and Rock Creek, Oregon, were added to a moderately acid Willamette silt loam (fine-silty, mixed, mesic Pachic Ultic Argixeroll) soil in a field experiment to investigate the effects of multiple applications of sludges with differing, low metal concentrations on sweet corn (Zea mays L.) yield and elemental concentration in leaf and kernel tissue and how these responses compare with those from commercial N fertilizer. Ammonium sulfate (0, 100, 200, and 300 lb N/acre) and sewage sludge (a low rate: approximately 200; and a high rate: approximately 400 lb N/acre; and 400 lb N/acre plus lime) were added to the soil annually for 7 years. Fresh ear weight was taken and elemental analyses were conducted in Year 1, 2, 3, and 7. Higher yields were obtained on limed plots than on unlimed plots at the high sludge rate in Year 7. Six out of nine sludge treatments had higher total yields than 200 lb N/acre as (NH4)2SO4 in Year 7. Concentrations of leaf Cd, Zn, and Mn were significantly greater in Year 7 than in Year 3 due to application of sludge. In Year 7, leaf Cd and Zn concentrations were higher in corn fertilized with sludge than with (NH4)2SO4. The Zn, Cd, and Mn concentrations in leaf tissue were lower than without lime addition. Sludge and (NH4)2SO4 treatments had no effect on kernel Cd concentration. Only Portland sludge applications exceeded EPA recommendations (3 out of 7 years). All sludges were satisfactory N sources for sweet corn growth. (Author's abstract)
W91-06299

ASSESSMENT OF THE GENOTOXICITY OF PRODUCED WATER DISCHARGES ASSOCIATED WITH OIL AND GAS PRODUCTION USING A FISH EMBRYO AND LARVAL TEST.
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
For primary bibliographic entry see Field 5C.
W91-06365

PREVALENCE OF LEUKEMIA IN HEMOLYMPH OF SOFT-SHELL CLAMS, MYA ARENARIA, IN DORCHESTER BAY, BOSTON HARBOR.
Tufts Univ., Boston, MA. School of Veterinary Medicine.
For primary bibliographic entry see Field 5C.
W91-06373

SOLID/LIQUID SEPARATION: WASTE MANAGEMENT AND PRODUCTIVITY ENHANCEMENT.
For primary bibliographic entry see Field 5D.
W91-06421

MECHANICAL AND THERMAL TREATMENT OF DREDGED MATERIAL TO PRODUCE CERAMIC PELLETS.
Battelle-Inst. e.V., Frankfurt am Main (Germany, F.R.).
H. J. Hampel, P. Mehrling, and H. Kroening.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 213-226. 9 fig, 11 ref.

Descriptors: *Dewatering, *Dredge spoil, *Dredging wastes, *Land disposal, *Spoil banks, *Waste disposal, *Waste treatment, Centrifugation, Separation techniques, Wastewater treatment.

Hill-shaped deposition and the optimization of mechanical and thermal separation of dredged material (dewatering) from the harbor of Hamburg were examined in laboratory-scale, pilot-plant-scale, and field experiments. Partially dewatered, fine-grained material is deposited in stable hill-shaped land deposits. The sand-free and partially dewatered fine-grained material is piled up in slightly inclined layers, with sand layers in between. The hills are provided with surface covers on which layers of normal soil will be spread and where trees and plants can be grown. Mechanical treatment involves sand recovery by screening and sorting on a fluidized-bed. Various units, such as centrifuges, belt presses, and high-intensity pressure filters were tested to determine the optimum dewatering process. Pelletizing and thermal treatment experiments conducted so far have shown that the physical as well as the ecological properties of the pellets can be controlled in the firing process and are less dependent on the composition or contamination of the dredged material. The dredged material must have a solids content of at least 50 weight percent. The Lurgi traveling grate was selected for pellet production from dredged materials. The pellets were found suitable as concrete agglomerate and road-building material. (See also W91-06421) (Geiger-PTT)
W91-06435

SLUDGE METAL BIOAVAILABILITY.
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W91-06448

SLUDGE ORGANICS BIOAVAILABILITY.
New Mexico State Univ., Las Cruces. Dept. of Agronomy and Horticulture.
For primary bibliographic entry see Field 5B.
W91-06449

USING WASTE MANAGEMENT PRODUCTS AS AN ALTERNATIVE TO DEPLETING NON-RENEWABLE FERTILIZER SOURCES.
Battelle Columbus Div., OH.
R. Velagaleti, and T. McClure.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 417-427. 1 fig, 6 tab, 23 ref.

Descriptors: *Fertilizers, *Land application, *Nitrogen, *Phosphorus, *Potassium, *Sludge disposal, *Sludge utilization, Crop production, Dewatering, Food-processing wastes, Manure.

The raw materials for the manufacture of nitrogen, phosphorus, and potassium fertilizers are non-renewable and are concentrated in few geographical regions of the world. The manufacture of these fertilizers is a highly energy intensive process that is not affordable in developing nations. Several waste management products are available that could be used as sources for N, P, and K. Collectible manures have estimated available nitrogen, phosphorus and potassium equivalent to 19, 38, and 61%, respectively of the amounts of these materials in manufactured commercial fertilizers. Almost all wastes from food processing could be used for fertilizing agricultural land. Dewatering methods are needed to make the use of manures and food-processing wastes as agricultural fertilizers less costly. The removal of water and concentration of the nutrients in sewage and sludge effluents by appropriate technologies will facilitate rapid expansion of the utilization of this renewable waste resource for agricultural use. (See also W91-06421) (Geiger-PTT)
W91-06450

SEWAGE SLUDGE APPLICATION TO AGRICULTURAL LAND.
Battelle Memorial Inst., Columbus, OH.
A. R. Gavaskar, M. F. Arthur, B. W. Cornaby, G. B. Wickramanayake, and T. C. Zwick.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 429-437. 3 tab, 9 ref.

Descriptors: *Land application, *Nitrogen, *Nutrients, *Path of pollutants, *Phosphorus, *Sludge disposal, Agricultural runoff, Ammonia, Crop production, Heavy metals, Models, Nitrates, Pathogens, Potassium.

Application of sewage sludge to agricultural land has the advantage of providing an economical disposal alternative for sludge, in addition to supplying plant needs of nitrogen, phosphorus, and potassium. Sludge must be digested to reduce the number of pathogens before land application. Nutrient such as nitrogen and phosphorus in sludge intended for land application can cause pollution of surface waters and groundwater during agricultural runoff. With careful management of sludge application rates, many potential problems can be avoided. The annual sludge application rate can be based on the nitrogen requirements for a specific crop because nitrogen is the major plant nutrient available in sludge. A sludge application model was developed for some of the major crop-producing states based on total-N, Ammonia-N, and nitrate-N inputs which were assumed to remain constant. Two conditions for slope of the land (0-3% and 3-6%) and two types of application (surface and incorporated) were included in the model. Soil types used in the model are coarse, medium, and fine-textured. The percentage of land in a second-order stream watershed that can receive surface-applied sludge was also determined for various states and state regions based on runoff calculated by the universal soil loss equation. (See also W91-06421) (Geiger-PTT)
W91-06451

LONG-TERM ENVIRONMENTAL EFFECTS ASSOCIATED WITH LAND APPLICATION OF MUNICIPAL SLUDGES: A REVIEW.
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. C. Chang, and A. L. Page.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 439-454. 1 fig, 7 tab, 79 ref.

Descriptors: *Biodegradation, *Cycling nutrients, *Environmental effects, *Land application, *Path of pollutants, *Sludge disposal, Carbon, DDT, Nitrogen, Pathogens, Phosphorus, Polychlorinated biphenyls, Sulfur, Trace elements.

The long-term environmental effects associated with the land application of municipal sludges were studied by evaluating how the sludge constituents may be assimilated in the soil through biochemical cycling of carbon, nitrogen, phosphorus, and trace elements and by reviewing related experimental data. During the course of a land application, the majority of sludge constituents are readily assimilated in the soils through the biochemical cycles. As the ability of the biochemical cycles to accommodate trace metals is limited, the trace metals invariably accumulate in the soil layer where the sludges are mixed and will be present in the soil essentially indefinitely. Because of their long degradation half-life and their strong adsorption by the soils, many organic chemicals such as DDT and polychlorinated biphenyls are assimilated into the C cycle at a very slow rate. It may take as long as 40 to 75 years for > 99% of the added chemicals to be degraded. With time, parasite ova present in sludge are expected to be inactivated. However, because these ova are able to survive the adverse environmental conditions, the sludge-treated soils may remain infectious for several years after the termination of sludge application. (See also W91-06421) (Author's abstract)
W91-06452

WASTE MINIMIZATION AND RECYCLING WITH MEMBRANE FILTER PRESSES.
Du Pont de Nemours (E.I.) and Co., Newark, DE. Engineering Dept.
For primary bibliographic entry see Field 5D.
W91-06459

EMERGING TECHNOLOGIES IN HAZARDOUS WASTE MANAGEMENT.
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 5G.
W91-06655

EMERGING TECHNOLOGIES FOR HAZARDOUS WASTE MANAGEMENT: AN OVERVIEW.
Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W91-06656

FACTORS INFLUENCING MOBILITY OF TOXIC METALS IN LANDFILLS OPERATED WITH LEACHATE RECYCLE.
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. P. Gould, W. H. Cross, and F. G. Pohland.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 267-291, 15 fig, 4 tab, 5 ref. EPA Cooperative Agreement CR-812158.

Descriptors: *Hazardous wastes, *Heavy metals, *Landfills, *Leachates, *Path of pollutants, *Waste disposal, Cadmium, Chromium, Domestic wastes, Lead, Mercury, Migration, Mobility, Nickel, Sludge, Sorption, Sulfates, Sulfides, Toxic wastes, Zinc.

Ten simulated landfill columns containing shredded municipal refuse were operated for over three years. Five were operated in the conventional single-pass mode while the other five were operated with leachate containment and recycle. Sludges containing an array of toxic metals (Cd, Cr, Ni, Hg, Pb, Zn) were added to three columns at low, moderate, and high levels. The concentrations in the leachate of these metals was monitored along with other parameters such as pH, sulfide, sulfate, and chloride. It was found that a broad range of mechanisms limited the mobility of the metals in the leachates. The chemical mechanisms included direct reduction to the element (Hg), precipitation by reductively generated sulfide (Cd, Zn, Pb, Ni), and precipitation by sulfate, in the case of lead, during the acid phase. Acid phase attenuation of zinc, cadmium and nickel suggested either the operation of physical sorptive mechanisms or the impact of localized regions of alkaline conditions within the columns associated with the codisposed metal sludges themselves. The fact that all observed processes had the effect of reducing metal mobilities suggests that municipal solid waste has a capacity for minimizing the mobility of toxic metals. This might be used to great advantage in conjunction with a judicious program of codisposal of metal processing waste residues with domestic refuse. (See also W91-06655) (Author's abstract)
W91-06671

SORPTIVE BEHAVIOR OF SELECTED ORGANIC POLLUTANTS CODISPOSED IN A MUNICIPAL LANDFILL.
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
D. R. Reinhart, J. P. Gould, W. H. Cross, and F. G. Pohland.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. 4 fig, 6 tab, 24 ref. EPA Cooperative Agreement CR-812158-01.

Descriptors: *Hazardous wastes, *Landfills, *Organic compounds, *Path of pollutants, *Waste disposal, Benzenes, Lipids, Naphthalenes, Phenols, Plastics, Sediments, Soil contamination, Sorption.

The impact of organic compound characteristics, leachate components, and the solid waste matrix on the fate of selected organic compounds codisposed with municipal refuse was evaluated. Test compounds included dibromomethane, trichloroethene, 1,4-dichlorobenzene, 2-nitrophenol, nitrobenzene, 2,4-dichlorophenol, 1,2,4-trichlorobenzene, naphthalene, and gamma-hexachlorocyclohexane. Bench top tests were employed to characterize the sorption process. Equilibrium sorbed and solution concentrations for nine test compounds were linearly related, with the coefficient of linearity well correlated with the octanol/water partition coefficient. The sorption partition coefficients normalized to carbon content were comparable to coefficients measured for similar hydrophobic compounds on soils and sediments. The majority of refuse sorption of hydrophobic test compounds was found to occur on low energy surfaces such as lipids and plastics. The affinity of the refuse for organic compounds enhances the assimilative capacity of the landfill and affords opportunity for more complete degradation of these constituents. (See also W91-06655) (Author's abstract)
W91-06672

ENERGY WASTE STABILIZATION TECHNOLOGY FOR USE IN ARTIFICIAL REEF CONSTRUCTION.
Florida Inst. of Tech., Melbourne. Dept. of Chemical and Environmental Engineering.
C. S. Shieh, I. W. Duedall, E. H. Kalajian, and F. J. Roethal.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 328-344, 3 fig, 6 tab, 38 ref.

Descriptors: *Aquatic habitats, *Artificial reefs, *Electric power industry, *Waste disposal, *Waste stabilization, *Waste utilization, Coal ash, Colonization, Flue-gas sludge, Incineration ash, Marine organisms, Oil ash.

Stabilization methodology has been applied in recent years to a variety of energy wastes, such as coal ash, flue-gas desulfurization sludge, oil ash, and incineration ash. The primary purpose of the research has been to develop and evaluate stabilized waste materials that can be used for the construction of artificial reefs. The methodology involves mixing granular solid wastes with chemical additives, fabrication of the reef block, followed by curing at a constant temperature for a period of time, so that a solid block is produced.

The stabilized energy waste blocks should have the following characteristics: a minimum strength of 2000 kPa, remain stability on the sea floor, minimal surface erosion, minimal leaching of metals, suitability as a settling base for biological colonization, and economical feasibility. On-going monitoring programs over a number of years have been designed to demonstrate the environmental feasibility of the stabilization technology. To date, the reef blocks fabricated using particulate energy wastes have maintained their physical and chemical integrity in the marine environment without causing adverse effects on marine organisms. Colonization of marine organisms occurs rapidly on the surface of the stabilized waste blocks. No significant differences in settlement density have been found between the reefs composed of stabilized energy blocks and those composed of concrete blocks. (See also W91-06655) (White-Reimer-PTT)
W91-06674

TREATMENT AND DISPOSAL OPTIONS FOR A HEAVY METALS WASTE CONTAINING SOLUBLE TECHNETIUM-99.
Oak Ridge Gaseous Diffusion Plant, TN.
For primary bibliographic entry see Field 5D.
W91-06675

PEPTIDE SYNTHESIS WASTE REDUCTION AND RECLAMATION OF DICHLOROMETHANE.
Rockefeller Univ., New York.
For primary bibliographic entry see Field 5D.
W91-06677

LAND AND LIQUID DISPOSAL BANS.
Environmental Protection Agency, Washington, DC. Office of Solid Waste.
S. Weil, and M. Kidwell.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 1-11, 3 tab.

Descriptors: *Environmental policy, *Hazardous waste disposal, *Hazardous wastes, *Land disposal, *Legislation, *Waste disposal, Environmental protection, Permits, Regulations, Standards, Waste storage, Waste treatment.

The Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) were enacted on November 8, 1984. Among other things, these far-reaching amendments require EPA to evaluate all hazardous wastes according to a strict schedule to determine whether land disposal of these wastes is protective of human health and the environment. For wastes that are restricted from land disposal, the amendments require EPA to set levels or methods of treatment which substantially diminish a waste's toxicity or reduce the likelihood that a waste's hazardous constituents will migrate. Beyond specified dates, restricted wastes which do not meet the treatment standards are prohibited from land disposal. A review of the restrictions and treatment requirements is presented. Topics covered include: (1) treatment standards; (2) variances and extensions; (3) treatment requirements for surface impoundment exemption; (4) prohibitions on dilution; (5) storage prohibitions; (6) the permit program; (7) testing and record keeping; (8) treatment standards for dioxins; and (9) information requirements. (See also W91-06678) (White-Reimer-PTT)
W91-06679

WASTE MINIMIZATION LIABILITY ISSUES.
Latham and Watkins, Los Angeles, CA.
For primary bibliographic entry see Field 5G.
W91-06680

SOURCE REDUCTION--PARTS CLEANING.
Parker and Amchem, Ambler, PA.
E. A. Rodzewich.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 37-43.

Descriptors: *Cleaning, *Hazardous waste disposal, *Hazardous wastes, *Solvents, Air pollution control, Chlorinated hydrocarbons, Cleaning materials, Halogenated organic compounds, Hydrocarbons, Operating policies, Regulations, Waste reduction.

The use of solvents for parts cleaning and some of the measures being taken by industry to reduce or eliminate solvents are discussed. Source reduction of solvents can occur in several ways: (1) through complete elimination of solvents; (2) through reduction of the absolute quantity of solvents to the minimum; or (3) through the use of operational procedures such as counterflow mechanics to control solvent use. The possibility and probability of using any of these techniques for source reduction depends to a great extent on the degree of cleanliness required and on the type of surface or combinations of surfaces to be cleaned. The most commonly used solvents for parts cleaning are the aromatic and aliphatic hydrocarbons, ketones, esters, butyl cellosolve, and various halogenated types such as methylene chloride or perchlorethylene. These are very effective for removing greases, fats, and waxes from metal, glass, and plastic surfaces. The halogenated solvents such as methylene chloride are exceptional as paint strippers. With the increased knowledge of the harmful effects of exposure to a large number of solvents and the increased number of regulations governing solvent emissions and air quality, there is a shifting away from solvent usage in cleaners. Recently, high solid formulations have been developed and sold commercially. These products perform as well as the solvent-based products, and they possess several advantages over the solvent-based materials such as non-flammability, 10 to 20% greater coverage, and no restriction as to the construction of spray guns. (See also W91-06678) (White-Reimer-PTT)
W91-06682

SOLVENT WASTE MINIMIZATION BY THE COATINGS INDUSTRY.
PPG Industries, Inc., Pittsburgh, PA.
N. H. Frick, and G. W. Gruber.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 44-47, 2 tab.

Descriptors: *Chemical industry, *Coatings, *Environmental protection, *Hazardous materials, *Solvents, *Waste reduction, Aesthetics, Corrosion, Polymers, Safety, Waste disposal.

The reasons for solvent use in coatings is examined by looking at product requirements along with recent actions being taken by coatings manufacturers, application equipment manufacturers, and end users to reduce solvent usage. Coatings can be broadly defined as decorative and/or functional materials which are applied to the surface of an object. Corrosion protection is one reason for using coatings. Other reasons are aesthetics, durability, chemical resistance, flexibility, and adhesion. Early coatings were essentially all solvent-reduced products from natural products such as lacquer, coal tar, and oils. New synthetic polymers used in coatings include epoxies, acrylics, fluorocarbons, polyesters, urethanes, and polyamides. Reduction and elimination of solvents in coatings has recently become a priority. In addition to environmental safety, solvent reduction or elimination can improve product safety through reduced chemical exposure and flammability. Recent advances in coatings technology include high solids coatings, water reducible coatings, powder coatings, 100 percent reactive coatings, electrodeposition, and application efficiency improvements. (See also W91-06678) (White-Reimer-PTT)
W91-06683

WHAT TO DO WITH HAZARDOUS WASTE: REGULATIONS, MANAGEMENT, AND DISPOSAL.
RECRA Environmental, Inc., Amherst, NY.
For primary bibliographic entry see Field 5G.
W91-06684

WASTE REDUCTION FOR CHLORINATED SOLVENTS USERS.
Dow Chemical U.S.A., Midland, MI.
For primary bibliographic entry see Field 5D.
W91-06685

ON-SITE REUSE AND RECYCLE OF SOLVENTS.
Salvesen (Robert H.) Associates, Red Bank, NJ.
For primary bibliographic entry see Field 5D.
W91-06686

COMMERCIAL (OFF-SITE) SOLVENT RECLAMATION.
Solvent Resource Recovery, Inc., West Carrolton, OH.
For primary bibliographic entry see Field 5D.
W91-06687

MAKING THE MOST OF BOTTOMS AND RESIDUALS.
Dames and Moore, San Francisco, CA.
For primary bibliographic entry see Field 5D.
W91-06688

TREATMENT: SOLVENT WASTESTREAMS.
Salvesen (Robert H.) Associates, Red Bank, NJ.
For primary bibliographic entry see Field 5D.
W91-06689

TREATMENT OF SPENT SOLVENT WASTEWATERS: FOCUS ON CHANGING ECONOMICS.
Versar, Inc., Springfield, VA.
For primary bibliographic entry see Field 5D.
W91-06690

INFLUENCE OF IRRIGATION WITH PULP AND PAPER MILL EFFLUENT ON SOIL CHEMICAL AND MICROBIOLOGICAL PROPERTIES.
Tamil Nadu Agricultural Univ., Coimbatore (India). Dept. of Agricultural Economics.
K. Kannan, and G. Oblisami.
Biology and Fertility of Soils BFSOEE, Vol. 10, No. 3, p 197-201, 1990. 7 tab, 27 ref.

Descriptors: *Industrial wastewater, *Irrigation effects, *Pulp wastes, *Soil chemistry, *Soil organisms, *Wastewater irrigation, Microorganisms, Monitoring, Nutrients, Organic carbon, Population density, Sodium, Soil properties, Sugarcane.

A study was conducted on the impact of irrigation with pulp and paper mill effluent on soil chemical and microbiological properties. Irrigation of sugarcane crops with combined pulp and paper mill effluent increased soil pH, organic carbon (C), nitrogen, phosphorus, and potassium levels. Over a period of 15 years effluent applications increased exchangeable sodium by 4.5 fold compared with control soil (well water irrigated), which ultimately elevated the sodium adsorption ratio of the soils. The combined effluent irrigation increased the soil populations of bacteria, actinomycetes, fungi, rhizobia, and yeasts. The populations of soil microorganisms were higher after 15 years of effluent treatment; these populations were directly proportional to soil organic carbon and to the available nutrient status of the soils. Regular monitoring of microflora showed a considerable change in the populations from one sampling month to another. Soil samples, including the control, collected in May (summer) showed maximum counts of bacteria, fungi, rhizobia, and yeasts. (Author's abstract)
W91-06788

LAND APPLICATIONS: ITS EFFECTIVENESS IN PURIFICATION OF URBAN AND INDUSTRIAL WASTEWATERS IN LA MANCHA, SPAIN.
Universidad de Alcala de Henares, Madrid (Spain). Dept. of Geology.
For primary bibliographic entry see Field 5D.
W91-06799

EARTHWORM AND SOIL MICROARTHROPOD RESPONSES TO OILY WASTE APPLICATION.
Niagara Mohawk Power Corp., Syracuse, NY.
For primary bibliographic entry see Field 5C.
W91-06962

COLOR CHANGES OF ORGANIC WASTES DURING COMPOSTING AND MATURATION PROCESSES.
Centro de Edafologia y Biologia Aplicada del Segura, Murcia (Spain).
C. Garcia, T. Hernandez, and F. Costa.
Soil Science and Plant Nutrition, Vol. 36, No. 2, p 243-250, 1990. 4 fig, 4 tab, 10 ref.

Descriptors: *Analytical methods, *Composting, *Land disposal, *Optical properties, *Organic wastes, *Soil amendments, *Waste disposal, Anaerobic conditions, Carbon, Chemical properties, Colorimetry, Microorganisms, Plant growth, Sludge, Soil organisms, Statistical analysis, Wastewater analysis.

When composts are applied to the soil before complete maturity they have a negative effect on the crops because soil microorganisms and plants compete for the nitrogen. Also, extremely anaerobic conditions are often created and plant growth is retarded. The changes in the degree of lightness of different organic residues were examined because these residues become darker during the composting and maturation processes. Color changes of different mixtures of sewage sludge or city refuse during the composting and maturation processes were investigated by applying the method of measurement for the color of the materials based on the CIE 1931 Standard Colorimetric System. Optical density changes of the alkaline extracts from the samples during these processes were also determined. The stimulus value Y and Munsell notation value decreased rapidly during the first 65 days of piling and then reached a constant value. While organic wastes were rotting and maturing, the stimulus value Y and the water-soluble C/N (WSC/N) ratio equally decreased. A positive correlation between the stimulus value Y and the WSC/N ratio with a correlation coefficient of 0.631 (p=0.001) was observed. Correlation coefficients between the stimulus value Y and C/N ratio were not significant. Optical density of the alkaline extracts from the different samples increased during the piling period and remained nearly constant during the maturation process. It was concluded that constant values of absorbance/extractable C indicate a good maturity degree of the composts. (Author's abstract)
W91-06971

METHOD FOR MONITORING THE DECOMPOSITION PROCESS IN SOIL OF ORGANIC WASTEWATERS WITH HIGH STRENGTH AND LOW C/N RATIO.
Tokyo Inst. of Tech. (Japan). Research Lab. of Resources Utilization.
M. Hirai, T. Endo, K. Fujie, M. Shoda, and H. Kubota.
Soil Science and Plant Nutrition, Vol. 36, No. 3, p 397-408, 1990. 4 fig, 6 tab, 16 ref.

Descriptors: *Analytical methods, *Carbon, *Decomposition, *Nitrogen, *Organic wastes, *Wastewater disposal, Animal wastes, Chromatography, Composting, Effluents, Japan, Municipal wastes, Quantitative analysis, Sludge disposal, Soil types, Wastewater analysis, Wastewater irrigation.

The use of gel chromatography of the water extract from solid compost samples, such as sewage sludge, municipal waste, livestock manure, and plant residues to monitor compost maturity was evaluated. The decomposition processes in soils of four kinds of high strength organic wastewaters, such as squeezed fluid of pig manure (SPM), bonito processing wastewater (BPW), effluents from methane fermentation of squeezed fluid of pig manure (EMP), and from bonito processing wastewater (BPW) were analyzed by the gel chromatography method and the Komatsuna 72 h seedling test. SPM and BPW, and their effluents from methane fermentation were studied in pot experiments in a model case of land application of organic wastewaters with high strength and low C/N ratio. Kanagawa alluvial soil (upland soil) and Kagoshima volcanic ash soil (upland soil) were used. The stabilization period of these four wastewaters in Kanagawa soil determined by gel chromatography was 14 days for an effluent from methane fermentation of bonito processing wastewater (EMB), 21 days for EMP and BPW, and 28 days for SPM. Stabilization of all wastewaters occurred 1 week later in the Kanagawa soil than in the Kagoshima soil. In spite of apparent stabilization, inhibition of the growth of a 72 h seedling of Komatsuna (Brassica campestris L. var. rapifera-froug) was observed in EMB due to the accumulation of NOs-N especially in the oligotrophic Kanagawa soil. In this case, monitoring of stabilization was achieved by both gel chromatography of a 1:2.5 water extract of the wastes and soil mixtures and the use of a Merckoquant Nitrite Test strip for the detection and semiquantitative analysis of NO2 ion. (Agostine-PTT)
W91-06978

POLLUTANTS IN SOIL, PARTICULARLY HEAVY METALS AND HARMFUL ORGANIC SUBSTANCES, AFTER YEARLY USAGE OF MUNICIPAL WASTES (SCHADSTOFFE IM BODEN INSBESONDERE SCHWERMETALLE UND ORGANISCHE SCHADSTOFFE AUS LANGJAHRIGER ANWENDUNG VON SIEDLUNGSABFALLEN).
Landwirtschaftliche Untersuchungs- und Forschungsanstalt, Speyer (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W91-07040

5F. Water Treatment and Quality Alteration

CHARACTERIZING SURFACE WATERS THAT MAY NOT REQUIRE FILTRATION.
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 2H.
W91-05959

EVALUATING THE PERFORMANCE OF SLOW SAND FILTERS IN NORTHERN IDAHO.
Idaho Div. of Environmental Quality, Coeur d'Alene.
S. A. Tanner, and J. E. Ongerth.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 51-61, December 1990. 8 fig, 4 tab, 14 ref.

Descriptors: *Drinking water, *Giardia, *Idaho, *Sand filters, *Water treatment, *Water treatment facilities, Fecal coliforms, Heterotrophic bacteria, Turbidity, Water quality, Water quality control, Water quality standards.

Three slow sand filter plants in northern Idaho were examined to determine the quality of performance and their ability to provide effective water treatment for their respective communities. During the one-year study, the plants were sampled weekly for measurement of turbidity, total (TC) and fecal (FC) coliforms and heterotrophic plate count (HPC). Samples were also analyzed for Giardia cysts and particulates. Turbidities averaged from 0.2 to 0.5 ntu, with values exceeding 1.0 ntu only 10 to 15 % of the time. Bacteria concentrations in the raw water were also low, with average TC levels from 10 to 30/mL, average FC levels <1/100 mL and average HPC levels from 50 to 100/mL Overall, relative to treated-water requirements (maximum containment levels), each plant had predominantly acceptable performance. Data from Giardia cyst analysis and particle counts indicate each of these filters provided some, but not complete, protection against Giardia transmission. The need for operator education and greater surveillance by regulatory personnel was evident for the maintenance and operational deficiencies noted at the filter plants. (Feder-PTT)
W91-05960

ANALYZING BIOFILM PROCESSES USED IN BIOLOGICAL FILTRATION.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. E. Rittmann.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 62-66, December 1990. 2 tab, 4 fig, 16 ref.

Descriptors: *Aerobic treatment, *Ammonium, *Biofilms, *Biological filters, *Biological treatment, *Drinking water, *Iron, *Manganese, *Nitrification, *Organic compounds, *Sand filters, *Sulfides, *Water pollution treatment, *Water treatment.

This study analyzes the kinetics of aerobic filters used for nitrification and oxidation of biodegradable organic material. A mechanistic biofilm model is applied through the use of four fundamental parameters and normalized learning curves. For nitrification, large-granule beds are used successfully with fluxes of up to 0.38 kg NH(4+)N(-)/1000 sq m day, which is similar to the loading used in waste-water nitrification. Fluidized beds and slow sand beds are operated at much lower fluxes (up to 0.032 and 0.003 kg NH(4+)N(-)/1000 sq m day, respectively), which clearly correspond to the low-load region of the normalized curve. For oxidation of biodegradable organic material, all fluxes used successfully in drinking water treatment ar 20 or more times lower than for biofilm processes used in wastewater treatment. The highest flux was 0.14 kg COD/1000 sq m day for an aerated pozzolana bed; loads to fluidized beds and slow sand filters were approximately 10 and 100 times smaller. These low loads reflect the need to remove biodegradable organic material to as close to the minimum substrate concentration that is capable of sustaining a steady-state biofilm, as possible in drinking water. (Author's abstract)
W91-05961

DIATOMACEOUS EARTH FILTRATION OF CYSTS AND OTHER PARTICULATES USING CHEMICAL ADDITIVES.
Camp, Dresser and McKee, Inc., Cambridge, MA.
P. F. Schuler, and M. M. Ghosh.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 67-75, December 1990. 8 fig, 6 tab, 14 ref. PADER Contract ME86561.

Descriptors: *Diatomaceous earth, *Disinfection, *Drinking water, *Filtration, *Water treatment, Alum, Coagulation, Coliforms, Giardia, Pennsylvania, Surface water, Turbidity.

Diatomaceous earth (DE) filtration was evaluated for removal of Giardia muris, Cryptosporidium, turbidity and coliform bacteria from a surface water. The effect of cationic polymers and alum on this removal was also investigated. All filtration experiments were conducted using the surface water at Shingletown, Pa. At naturally occurring concentrations, DE filters can remove 100% of Giardia muris cysts and 99.9% of Cryptosporidium oocysts. The removal of Cryptosporidium was further improved by using alum. The addition of chemical coagulants increased the removal of total coliform bacteria from 20% to more than 97%. Chemical coagulants enhanced the removal of turbidity by removing more of the particles that were smaller than 3 micrograms in size. The amount of turbidity removed was directly related to the dosage of the chemical. The use of chemical flocculants reduced the length of filter runs, even for low-turbidity waters, because of higher head losses. (Feder-PTT)
W91-05962

COAGULATION PRETREATMENT FOR ULTRAFILTRATION OF A SURFACE WATER.
V. L. Turcaud, M. R. Wiesner, J. Y. Boltero, and J. Mallevialle.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 76-81, December 1990. 7 fig, 1 tab, 23 ref. National Science Foundation Grant BCS-8909722.

Descriptors: *Chemical coagulation, *Drinking water, *Pretreatment of water, *Ultrafiltration, *Water treatment, Dissolved organic carbon, Membrane processes, Ozonation, Surface water.

Polysulfone ultrafiltration membranes were used to treat water from the Seine River, France with and without coagulation pretreatment. Pretreatment with polyaluminum or ferric chloride coagulant reduced the rate of reversible fouling and increased the removal of dissolved organic carbon (DOC) but did not reduce the rate or extent of irreversible fouling of the membrane. Seine River water that had been treated by coagulation, filtration and ozonation, i.e., tap water, also produced significant irreversible fouling. Most of the DOC in flocculated Seine River water and tap water consisted of polysaccharide materials of low molecular weight. Irreversible fouling may be due to the adsorption of these materials on membrane surfaces. (Author's abstract)
W91-05963

ULTRAFILTRATION OF LAKE WATER: EFFECT OF PRETREATMENT ON THE PARTITIONING OF ORGANICS, THMFP, AND FLUX.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
J. M. Laine, M. M. Clark, and J. Mallevialle.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 82-87, December 1990. 4 fig, 2 tab, 14 ref. USEPA Cooperative Agreement EPACR812582.

Descriptors: *Activated carbon, *Dissolved solids, *Flocculation, *Trihalomethanes, *Ultrafiltration, *Water treatment, Coagulation, Fluctuations, Lakes, Membrane processes, Pretreatment of water, Turbidity.

Pretreatment processes consisting of various combinations of coagulation-flocculation and powdered activated carbon (PAC) adsorption were evaluated for use in ultrafiltration (UF) of Lake Decatur, IL water. Permeate quality was judged on the basis of the removal of nonpurgeable organic carbon (NPOC), ultraviolet-light-absorbing compounds, turbidity and trihalomethane (THM) precursors. The development of permeate flux and the flux recovery after backwash were also monitored and modeled with the series resistance model. It was shown that for ultrafiltration to be effective in removing nonpurgable organic carbon (NPOC) and THM precursors, pretreatment with PAC is required. Coagulation treatment before UF also results in the removal of more organic matter than by UF alone but appears to be more important in conditioning the filter cake and enhancing flux. (Author's abstract)
W91-05964

PERFORMANCE AND ANALYSIS OF TRACER TESTS TO DETERMINE COMPLIANCE OF A DISINFECTION SCHEME WITH THE SWTR.
East Bay Municipal Utility District, Oakland, CA.
S. M. Teefy, and P. C. Singer.
Journal of the American Water Works Association JAWWA5, Vol. 82, No. 12, p 88-98, December 1990. 12 fig, 8 tab, 7 ref.

Descriptors: *Disinfection, *Drinking water, *Water treatment, Chlorine, Giardia, Performance evaluation, Time series analysis, Tracers, Water analysis, Water quality standards, Water treatment facilities.

The Surface Water Treatment Rule (SWTR) contains tables of disinfectant CT (concentration x time) values that have been demonstrated to achieve the required degree of inactivation of viruses and Giardia cysts. If the CT product for a water treatment plant meets or exceeds those in the SWTR tables, it is assumed this inactivation has been achieved. The objective of this study was to compare two methods for calculating C and T. Tracer tests were conducted to characterize the behavior of flow through the process units of water treatment plants. Tracer tests have been demonstrated to be a very effective method of characterizing the behavior of flow through process units in water treatment plants. Residence time distributions can be used to describe flow behavior and develop and calibrate reactor models that closely approximate the behavior of the real tanks. Effective CT values calculated based on the residence time distribution and the kinetics of chlorine decay, indicated that a substantial margin of safety in the degree of pathogen inactivation is built into the SWTR under the most conservative interpretation. (Feder-PTT)
W91-05965

NETWORK MANAGEMENT--THE BRADFORD EXPERIENCE.
Yorkshire Water Authority (England). Western Div.
R. P. Whitaker, C. D. Newsome, and M. R. Parvin.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 410-421, October 1990. 5 fig, 1 ref.

Descriptors: *Computer models, *England, *Water conservation, *Water demand, *Water distribution, *Water resources management, *Water supply, Digital map data, Leakage, Network design, Telemetry, Yorkshire.

The concept of network management in the Western Division of Yorkshire Water and its implementation in the Bradford area is examined, together with the role played by an integrated staff. Network management represents the program for the integration of individual initiatives, with one common base--the management of water supply and distribution. Network management is an integration of: network analysis; leakage control; pressure control; total water audit; source balancing/optimization; telemetry; asset management planning; and digital mapping/facilities management. Network management was implemented in the Bradford area using the GINAS suite of network-analysis which allowed the accurate modeling of the distribution and trunk mains by the creation of a number of large, dynamic, calibrated models. These models have enabled several optimization strategies to be developed with confidence and have facilitated the planning and implementation of district metering comprising 81 zones and serving 192,000 properties. The use of a battery-powered, full-bore, buriable electromagnetic flow meter was pioneered and allowed a cost saving over the traditional district meter installation. Indications of the meter's long-term reliability, acuracy, and low maintenance requirements are very encouraging. (Feder-PTT)
W91-05967

DRINKING WATER DIRECTIVE AND PROPOSED WATER SUPPLY (WATER QUALITY) REGULATIONS FOR SCOTLAND.
Strathclyde Regional Council, Glasgow (Scotland). Water Dept.
For primary bibliographic entry see Field 5G.
W91-05974

CHEMICAL ASPECTS OF WATER QUALITY AND HEALTH.
R. F. Packham.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 484-488, October 1990. 21 ref.

Descriptors: *Drinking water, *Public health, *Trace elements, *Water quality, *Water quality standards, Aluminum, Asbestos, Fluorides, Lead, Nitrates, Organic compounds, Pesticides, Pollutants, Sodium.

During the last two decades there has been an information explosion on the nature of trace chemical contaminants in drinking water. Some of the substances found at microgram/liter levels and below are potentially harmful to health, although firm evidence of adverse effects at these levels is lacking. As a precautionary measure, limits have been and are being set for an increasing number of chemicals in drinking water. Those set for trace organic compounds are normally based on toxicological data, with substantial safety factors to make allowance for uncertainties. This contrasts with the more marginal safety factors involved in some older limits such as that for lead. There is a need for a proper perspective on the minute risks associated with chemical contaminants, such as aluminum, asbestos, disinfection by-products, water hardness, lead, nitrate and pesticides, in comparison with the major bacteriological hazards associated with inadequate disinfection. (Author's abstract)
W91-05976

WATER TREATMENT FOR HEALTH HAZARDS.
R. G. Ainsworth.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 489-493, October 1990. 1 fig, 25 ref.

Descriptors: *Giardia, *Nitrates, *Organic solvents, *Pesticides, *Public health, *Volatile organic compounds, *Water treatment, Adsorption, Aeration, Biological treatment, Filtration, Ion exchange, Reverse osmosis, Sand filters.

The performance of treatment processes is reviewed for the removal of five potential contaminants of water supplies: pesticides; volatile organic solvents, nitrates, Cryptosporidium oocysts, and Giardia cysts. Adsorption on activated carbon can be used for pesticide removal, but more information is required to assist in selection and operation. Treatment methods for removing volatile organic solvents are restricted to aeration or adsorption processes. Nitrate removal can be accomplished through use of the following technologies: biological denitrification; ion exchange; reverse osmosis through a membrane; and electrodialysis through a membrane. Physicochemical treatment can remove Giardia, but optimization and control are critical factors. Information available on the effects of physicochemical treatment on oocyst removal is limited. One study of slow sand filters reported removal efficiencies of 99.98%. More information is required on the performance of the coagulation/sedimentation and filtration processes on oocyst removal. Ozone is more effective than chlorine for inactivating both Cryptosporidium and Giardia that have penetrated the treatment works. (Feder-PTT)
W91-05977

CHLORINATED DRINKING WATER AND BLADDER CANCER: EFFECT OF MISCLASSIFICATION ON RISK ESTIMATES.
Iowa Univ., Oakdale. Dept. of Preventative Medicine and Environmental Health.
C. F. Lynch, R. F. Woolson, T. O'Gorman, and K. P. Cantor.
Archives of Environmental Health AEHLAU, Vol. 44, No. 4, p 252-259, July/August 1989. 5 tab, 21 ref. EPA Grant CR806301, National Cancer Institute Contract N01CP43200, Public Health Service Preventive Oncology Academic Award 1 K07 CA 1181-01A1 and National Cancer Institute Research Grant CA39065.

Descriptors: *Bladder cancer, *Chlorination, *Drinking water, *Error analysis, *Risk assessment, *Water treatment, Chlorination exposure, Human diseases, Iowa, Mathematical models, Misclassification, Regression analysis.

Data are presented from the Iowa portion of the National Bladder Cancer Case-Control Study demonstrating the effect of misclassification on depressing odds ratio estimates for years of exposure to chlorinated drinking water and bladder cancer. Four methods of quantifying chlorination exposure with sequentially decreasing degrees of misclassification are presented for the 268 bladder cancer cases and 658 population-based controls fulfilling criteria for inclusion in this study. Twenty-eight other risk factors for bladder cancer were considered along with chlorinated drinking water exposure estimated by Method 4. Stepwise regression models included as significant factors cigarette smoking ($p < .001$), chlorination exposure ($p = .038$), and irradiation to pelvic area ($p = .040$). Replacement of chlorinated drinking water expo-

sure estimated by Method 4 with any of the remaining three methods resulted in models that included cigarette smoking and irradiation to the pelvic area, but not chlorination exposure. Thus, misclassification of chlorination exposure signified the difference between observing and not observing an association with bladder cancer. This type of error is common in environmental epidemiology studies and its presence indicates that a result of no association for an environmental exposure must be interpreted with caution, particularly if the potential exists for random misclassification of the exposure variable. Analytical studies dealing with environmental exposures suspected of being associated with an adverse health outcome should involve as extensive a quantification of the exposure as feasible. (Medina-PTT)
W91-05982

DRINKING WATER FLOURIDATION AND OSTEOSARCOMA.
Alberta Univ., Edmonton. Environmental and Occupational Health Program.
S. E. Hrudey, C. L. Soskolne, J. Berkel, and S. Fincham.
Canadian Journal of Public Health CJPEA4, Vol. 81, No. 6, p 415-416, November/December 1990. 3 tab, 5 ref.

Descriptors: *Canada, *Cancer, *Drinking water, *Epidemiology, *Fluoridation, *Human diseases, Alberta, Bioassay, Laboratory methods, Public health, Toxicology.

Media reports beginning in late 1989, concerning results from a U.S. National Toxicology Program bioassay on rats exposed to sodium fluoride in drinking water, have rekindled the debate over the safety of fluoridated water. The bioassay which led to this furor showed the occurrence of osteosarcoma among male rats at the two highest fluoride doses (4 out of 80 exposed to 79 mg/L and 1 out of 50 exposed to 45 mg/L). No osteosarcoma was found in any of the controls or among female rats. The two major cities in the province of Alberta, Canada, have had different policies on fluoridation of drinking water and provided an opportunity to compare the incidence of osteosarcoma. Edmonton adopted fluoridation in 1967, while Calgary had not accepted fluoridation until it was passed in a municipal referendum in the fall of 1989. Data compared on these two cities failed to reveal any difference, or any apparent trend over time in the incidence of osteosarcoma. Because of the relatively crude nature of the evaluation, the lack of apparent differences does not preclude the existence of subtle differences. However, the most relevant aspect of these data for the concerned public is perhaps the low overall incidence of osteosarcoma in either city. To further demonstrate consistency in the lack of any association, an analysis of the provincial impact of osteosarcoma revealed no difference between urban and rural rates. Cancer risk, at worst, is extremely low. It is concluded that there is no link between fluoridation and osteosarcoma among Albertans. (Medina-PTT)
W91-05993

FOCUS ON TOXICOLOGICAL ASPECTS OF PESTICIDE CHEMICAL INTERACTION IN DRINKING WATER CONTAMINATION.
Milan Univ. (Italy). Ist. di Farmacologia e Farmacognosia.
D. Cova, G. P. Molinari, and L. Rossini.
Ecotoxicology and Environmental Safety EESADV, Vol. 20, No. 3, p 234-240, December 1990. 3 tab, 29 ref.

Descriptors: *Carcinogens, *Drinking water, *Drinking water pollution, *Literature review, *Mutagens, *Pesticide toxicity, *Synergistic effects, *Toxicology, *Water pollution effects, Analytical methods, Byproducts, Metabolites, Pesticide residues, Public health, Water quality standards, Water treatment.

Toxicological aspects related to chemical and microbial degradation of pesticides in water and to products derived from the interaction with xenobiotics found in water are reviewed. Cocarcinogenic and comutagenic effects of pesticides and their interaction with other chemical species found in water are presently a major concern. There is a need for new analytical methods suitable for detection of metabolites, in addition to pesticide residues at sensitivities required by government standards. Potential toxicological interactions due to environmental pollution, or to occupational exposure to pesticides and/or other chemicals, likewise, cannot be ignored. Other problems considered are those related to the water purification processes and to water contamination by pesticide synthesis byproducts or intermediates. These problems are significant because of their impact on human health. (Medina-PTT)
W91-05995

HETEROTROPHIC PLATE COUNTS AND THE ISOLATION OF BACTERIA FROM MINERAL WATERS ON SELECTIVE AND ENRICHMENT MEDIA.
Coimbra Univ. (Portugal). Dept. de Zoologia.
For primary bibliographic entry see Field 5A.
W91-06005

WATER QUALITY AND HEALTH.
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
For primary bibliographic entry see Field 5C.
W91-06060

CURRENT SITUATION AND PROBLEMS OF JAPANESE INTERNATIONAL COOPERATION IN THE FIELD OF WATER SUPPLY AND WASTE MANAGEMENT.
Ministry of Health and Welfare, Tokyo (Japan). Water Supply and Environmental Sanitation Dept.
For primary bibliographic entry see Field 6E.
W91-06062

PROVINCIAL WATER SUPPLY IN THAILAND AND THE WATER DECADE.
Waterworks Authority, Bangkok (Thailand). Planning Div.
W. Lowatanatrakul.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 223-228, 1991. 4 tab, 2 ref.

Descriptors: *Developing countries, *Thailand, *Water quality control, *Water supply, *Water treatment, Financing, Public health, Waste management, Water management.

In order to comply with the International Drinking Water Supply and Sanitation Decade Plan (1981-1990), the Thai government set up a target that by the year 1990 not less than 95% of the Thai population, or more than 50 million persons, will be served with clean water, compared with 40% at the outset of the Decade. However, in 1985, due to several constraints, the Provincial Waterworks Authority (PWA) revised its own target to cover only about 70% by the end of 1990. In 1988 it was estimated that about 2.883 million people in PWA's service areas or about 58.0% can be served by PWA's systems. If the population in service areas increases by 2.5% per year, PWA has to increase the number of connections at the rate of 12.62% per year for the remaining two years of the Decade in order to meet the 70% coverage target in 1990. A budget of about 7.485 million baht (US $229 million) was allocated in FY 1980-89 for the expansion of water supply systems and services. It was estimated that the budget in 1990 should not be less than 1,950 million baht if the same target is to be accomplished. At any rate, there are still many constraints that could hamper the achievement, such as inadequate water resources both in terms of quantity and quality (due largely to deforestation and pollution from human activities), inadequate manpower and equipment, inadequate budget, and inadequate tariff, since the present tariff only covers operating expenditures but not capital investments. (Author's abstract)
W91-06063

WATER QUALITY AND HEALTH (REVIEW OF THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE).
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
P. Benedek.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 229-235, 1991. 2 fig, 1 tab, 6 ref.

Descriptors: *Developing countries, *International commissions, *Water quality control, *Water treatment, Deforestation, Financing, Waste management, Water management, Water supply.

Widespread concern to ensure safe water and sanitary disposal of excreta and waste water for communities, households and individuals all over the world and particularly in developing countries led to the designation of the past decade (1981-1990) by the United Nations General Assembly as International Drinking Water Supply and Sanitation Decade. International organizations and other external support agencies were requested to intensify their cooperation with developing countries in planning, implementing and monitoring water supply and sanitation programs. Problems include surface water pollution from pathogens, chemicals, and excess nutrients, shallow aquifer pollution from waste disposal and agricultural practices, and natural pollution. Implementation of water treatment programs and waste treatment programs in developing countries is hindered by cost, availability of resources, and the level of expertise required to operate the programs. Future deterioration of water quality in developing countries is a consequence of increased industrial production, rapid increase in water use (particularly groundwater), deforestation, and the destruction of natural filter systems such as wetlands. (Tappert-PTT)
W91-06064

DEVELOPMENT OF DRINKING WATER QUALITY SURVEILLANCE IN MALAYSIA.
Ministry of Health, Kuala Lumpur (Malaysia). Engineering Services Div.
W. K. Lum.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 237-241, 1991. 1 fig.

Descriptors: *Malaysia, *Water quality control, *Water supply, *Water treatment, Public health, Sanitation, Waste management, Water management.

Under Malaysia's constitution water, water supplies, and sanitation are State matters and responsibilities while public health and the prevention of disease are concurrent State and Federal matters. Almost 95% of the urban population and 71% of the rural population are served by sanitary water supplies. The need for the development of a national program for surveillance of drinking water quality in Malaysia was identified in a country-wide survey on drinking water quality surveillance problems in 1983. The program was needed to define organizational responsibilities, functions, procedures, activities and follow-up remedial actions. The program was planned based upon WHO's 'Guidelines for Drinking Water Quality' (draft 1983), taking into consideration the survey findings, and implemented with reasonable success within the constraints of existing levels of manpower, facility and budgetary resources. It is believed that the quality of raw water sources will deteriorate further with increasing urbanization and development. The success of the national program for drinking water quality surveillance has been its ability to bring together various departments and agencies related to the provision of drinking water in a cooperative effort without the need to enforce any laws or regulations. The future will see the improvement of the program through the use of computers, improved laboratory facilities, better management, improved data management, and wider geographical coverage. (Tappert-PTT)
W91-06065

HEAVY METAL REMOVAL USING BOUND MACROCYCLES.
Brigham Young Univ., Provo, UT. Dept. of

Chemistry.
R. M. Izatt, R. L. Bruening, and M. B. Borup.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 301-308, 1991. 8 fig, 1 tab, 8 ref.

Descriptors: *Alkali metals, *Alkaline earth metals, *Heavy metals, *Macrocycles, *Silica, *Water treatment, Cadmium, Cations, Lead, Mercury, Silver, Solvents.

Cyclic polyether macrocycles have been shown to selectively remove certain metal ions from solvents such as water and methanol. Aza macrocycles bound to silica gel beads were found to selectively remove heavy metal cations such as Pb(2+), Cd(2+), Ag(+), and Hg(2+) from aqueous solutions. These bound macrocycles have a virtually infinite selectivity of binding with heavy metals over alkali and alkaline earth cations. The material is very stable and can be reused hundreds of times. Columns may be regenerated using an acidic eluent solution. Equilibrium constants were determined by column tests. Removal of heavy metals was demonstrated in bench scale tests using a synthetic contaminated water and in pilot scale tests using a naturally contaminated river water. Heavy metal concentrations could be effectively reduced to the microgram per liter level using the process. (Tappert-PTT)
W91-06072

REMOVAL OF CHLOROPHENOLS FROM WATER BY PHOTOCATALYTIC OXIDATION.
Delaware Univ., Newark. Dept. of Civil Engineering.
J. M. Tseng, and C. P. Huang.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 377-387, 1991. 7 fig, 2 tab, 34 ref.

Descriptors: *Catalysis, *Chlorophenols, *Oxidation, *Photochemistry, *Wastewater treatment, *Water treatment, Catalysts, Chemical reactions, Hydrogen ion concentration, Kinetics, Titanium dioxide, Ultraviolet radiation.

The photocatalyst titanium dioxide, upon irradiation with ultraviolet light, produces electrons and positive holes. The positive holes are strong oxidation agents that can oxidize organic compounds such as chlorophenol to mineral acids e.g. HCl and CO2. Factors such as pH, chlorophenol concentration, concentration of TiO2, and inorganic electrolytes that may affect the oxidation of chlorophenol were investigated. The rate of chlorophenol oxidation follows a first-order reaction with respect to the chlorophenol concentration and independent of pH. The rate increases with concentration of TiO2, reaches a maximum level at 3 g/l, then decreases to a constant value upon further increases in TiO2. Increasing the degree of chlorination appears to increase the extent and the rate of oxidation. For mono-chlorophenols the extent of oxidation is as follows: 4-chloro is greater than 3-chloro, which is greater than 2-chlorophenol. For dichlorophenols, the order is: 2,6-dichloro is approximately equal to 2,5-dichloro, which is greater than 2,4-dichloro, which is approximately equal to 2,3-dichlorophenol. For symmetrical chlorophenols, the oxidation increases in this order: 4-chloro is greater than 2,5-dichloro, which is greater than 2,4,6-trichlorophenol. Pentachlorophenol is rapidly decomposed but the extent of oxidation is not complete. (Author's abstract)
W91-06080

TOXORHYNCHITES AMBOINENSIS LARVAE RELEASED IN DOMESTIC CONTAINERS FAIL TO CONTROL DENGUE VECTORS IN A RURAL VILLAGE IN CENTRAL JAVA.
Naval Medical Research Unit No. 2, Manila (Philippines).
B. Annis, S. Nalim, Hadisuwasono, Widiarti, and D. T. Boewono.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 1, p 75-78, March 1990. 2 fig, 1 tab, 8 ref.

Descriptors: *Biocontrol, *Domestic water, *Human diseases, *Java, *Mosquitoes, *Public health, *Rural areas, *Toxorhynchites, *Water tanks, Adult growth stage, Cisterns, Growth stages, Habitats, Larval growth stage, Monitoring, Water storage.

The efficacy of Toxorhynchites amboinensis larvae for control of dengue vectors in household water storage containers was tested in a rural village in Central Java, Indonesia. Concrete cisterns and clay jars were the most common types of containers used for long-term water storage, although smaller numbers of metal drums were also used. All containers in use in the village received 5 to 10 second-instar to third-instar T. amboinensis larvae biweekly for 7 months. Vector surveillance (adult and larval) was conducted biweekly between treatments. No differences in biting rates or larval population indices were noted between the treatment and control areas. It is hypothesized that the multiplicity of larval habitats in this rural area accounted for the lack of impact of predator releases, which were directed solely toward artificial containers. (Author's abstract)
W91-06121

DRINKING WATER MICROBIOLOGY: PROGRESS AND RECENT DEVELOPMENTS.
Springer-Verlag, New York, Inc., New York. 1990. 502p. Edited by Gordon A. McFeters.

Descriptors: *Bacteria, *Drinking water, *Human pathogens, *Microbiological studies, *Pollutant identification, *Viruses, *Water treatment, Laboratory methods, Microbial transport, Microorganisms, Monitoring, Pathogenic bacteria, Pathogenic viruses, Statistical methods, Water quality.

The microbiology of drinking water remains an important worldwide concern despite modern progress in science and engineering. This book was written to provide individuals that deal with water quality with a single source of information concerning recent advances. Most of the findings presented have been generated in laboratory and field studies during the past 10 to 15 years. The book is organized into five parts. Part 1 deals with the microbiology of source water, and Part 2 discusses the microbiology of drinking water treatment. Both of these sections address issues relevant to conditions in and technologies appropriate for both industrialized and developing countries, such as activated carbon treatment and filtration. Part 3 includes chapters concerning the distribution of drinking water, and Part 4 deals with the occurrence and control of important pathogenic organisms such as giardia, Cryptosporidium, Yersinia entercolitica, Legionella, enteropathogenic bacteria and viruses. Finally, part 5 deals with microbiological and statistical methods used to monitor water quality. (See W91-06195 thru W91-06217) (VerNooy-PTT)
W91-06194

MICROBIOLOGICAL QUALITY OF SOURCE WATERS FOR WATER SUPPLY.
Environmental Protection Agency, Cincinnati, OH.
E. E. Geldreich.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 3-31, 1 fig, 21 tab, 82 ref.

Descriptors: *Drinking water, *Human pathogens, *Microbiological studies, *Water pollution sources, *Water quality, *Water quality control, *Water treatment, Bacteria, Literature review, Microorganisms, Pathogenic bacteria, Potable water, Raw water.

The greatest impact of water pollution on human health comes through drinking water, the source of which may be degraded by municipal sewage, stormwater runoff, cattle feedlot drainage, and discharges from meat and poultry processing plants. Groundwater used (by an estimated 60 million people), as untreated private to marginally treated public supplies, is not always free of these surface water contaminants. In fact contaminated groundwater supplies were responsible for over 50% of the waterborne outbreaks during the period 1940 to 1970. While water treatment technology can successfully process poor quality source waters containing in excess of 2000 fecal coliforms per 100 mg, producing potable water that meets the accepted drinking water standards, there is serous concern that the barrier to microbial breakthrough in the finished water may be dangerously small. Any momentary break in the treatment chain could allow substantial levels of microorganisms to enter the final product, i.e., potable water. For this reason, multiple barriers to pollution are necessary as an additional safeguard to prevent a breakthrough of pathogens into potable water supplies. These barriers include collection and treatment of all wastes, limiting treated effluent loading to receiving waters to that accumulative discharges do not exceed the self-purification capacity of the individual body of water, and appropriate water treatment to insure adequate consumer protection from any public health risk. (See also W91-06194) (VerNooy-PTT)
W91-06195

TROPICAL SOURCE WATER.
Savannah River Lab., Aiken, SC. Environmental Sciences Div.
T. C. Hazen, and G. A. Toranzos.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 32-53, 5 tab, 90 ref.

Descriptors: *Bioindicators, *Human pathogens, *Microbiological studies, *Tropical regions, *Water pollution sources, *Water quality, *Water supply, *Water treatment, Clostridium, Coliforms, Developing countries, Drinking water, Escherichia coli, Fecal streptococcus, Literature review, Microorganisms, Monitoring, Pathogenic bacteria, Reviews, Water quality control, Water quality standards.

Source water quality in most tropical areas differs from that of temperate areas in three major ways: physical and chemical; biological; and social and economic. Physical differences include water temperatures, thermal stratification of reservoirs and lakes due to small seasonal temperature changes, small variations in annual light intensity, and much greater water fluxes than in temperate areas. The higher productivity and temperature of the tropics create an environment that is high in organics and dominated by mesophilic and thermotolerant microorganisms. In general the microbial diversity of tropical source water is greater than temperate source water. The poorness of most tropical nations has meant that large portions of their populations do not have access to sewage disposal and potable water, and many traditional water sources are frequently heavily contaminated with human pathogens. There are problems when using traditional temperate indicators of biological pollution in tropical source waters. E. coli, the most commonly used indicator, may exist in high densities in the absence of pathogens or fecal sources and may be naturally occurring in some tropical areas. In addition, many pathogens have been shown to have shorter survival rates than E. coli, their presumed indicator. Alterative indicators have been investigated, including fecal streptococcus, Bifidobacterium spp., clostridium perfringens, and coliphages. At present, obligate anaerobes of their phages seem the best candidates for a better indicator for tropical source water, primarily due to their inability to survive outside the intestinal tract. The currently used fecal coliform assays are unacceptable for indicating fecal contamination of tropical source waters. (See also W91-06194) (VerNooy-PTT)
W91-06196

ASSIMILABLE ORGANIC CARBON (AOC) IN DRINKING WATER.
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
D. van der Kooij.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 57-87, 12 fig, 6 tab, 86 ref.

Descriptors: *Bacteria, *Drinking water, *Microbiological studies, *Organic carbon, *Pollutant

identification, *Testing procedures, *Water analysis, *Water quality, *Water treatment, Biomass, Laboratory methods, Literature review, Monitoring, Pathogenic bacteria, Water quality control, Water quality standards.

For the determination of an optimal sequence of water treatment processes, and the design of individual processes, assimilable organic carbon (AOC) measurements can play a role along with the steadily growing number of water quality parameters. The AOC concentration is the concentration of easily assimilable organic compounds available to an organism under applied test conditions. When properly treated, drinking water with a low concentration of compounds serving as energy sources for bacteria (e.g., organic compounds) can be obtained. In the past few years, a variety of techniques for determining the aftergrowth potential of drinking water has been described, based upon one of the following approaches: measurement of the amount of bacterial biomass after incubation of the water sample; measurement of the growth rate of bacteria; and measurement of the decrease of the concentration of organic compounds. Bacteria used in AOC determinations must produce cells of uniform size, grow rapidly at low concentrations of substrate on nonselective media, use a simple nitrogen source without requiring vitamin or other growth factors, and not be affected by low solute concentrations or changes in growth properties. Data from AOC measurements in water treatment and distribution in the Netherlands are examined. Based on data in studies examined, it is concluded that for limiting aftergrowth of heterotrophic bacteria, AOC concentrations in drinking water entering the distribution system should be less than 10 micrograms of acetate-C equivalents per liter. (See also W91-06194) (VerNooy-PTT)
W91-06197

EFFECT OF STARVATION ON BACTERIAL RESISTANCE TO DISINFECTANTS.
Stanford Univ., CA. Dept. of Microbiology and Immunology.
A. Matin, and S. Harakeh.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 88-103, 8 fig, 1 tab, 41 ref.

Descriptors: *Bacterial physiology, *Coliforms, *Disinfection, *Drinking water, *Microbiological studies, *Water quality, *Water treatment, Bacteria, Chemical treatment, Culturing techniques, Ecological effects, Laboratory methods, Nutrient requirements, Sensitivity.

Bacteria grown under laboratory conditions are used to evaluate the performance of a water disinfecting agent in the environment. The assumption that the sensitivity of laboratory-grown bacteria is a reliable measure of the sensitivity of natural populations was critically examined. An important difference between growth in the laboratory and in nature is the concentration of nutrients, since laboratory microorganisms are usually grown under rich conditions that are conducive to rapid and lavish growth. Many groups of workers have found that individual bacterial populations isolated from natural environments are markedly more resistant to disinfection than the same strains after growth in laboratory batch cultures. There is increasing evidence that nutritionally-deprived bacteria acquire increased resistance in general which is dependent on the synthesis of a unique set of proteins. Bacteria exposed to nutrient deprivation synthesize unique proteins, suggesting a global response of gene regulation at the onset of starvation. However, it is not known what the functions of the nutrient-deprivation proteins are, and how they protect the cell against deleterious influences. Hypotheses are that these proteins are involved in preventing degradation of essential proteins during stresses,in stabilizing DNA, or in making the cell envelope more resistant. (See also W91-06194) (VerNooy-PTT)
W91-06198

MICROBIOLOGY OF ACTIVATED CARBON.
American Water Works Service Co., Inc., Belleville, IL.
M. W. LeChevallier, and G. A. McFeters.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 104-119, 4 fig, 2 tab, 53 ref.

Descriptors: *Activated carbon, *Carbon filters, *Drinking water, *Filtration, *Granular activated carbon, *Microbiological studies, *Water quality, *Water quality control, *Water treatment, Bacteria, Disinfection, Microbial transport, Microorganisms, Pathogenic bacteria.

Despite its long history of use, the microbiology of activated carbon and its impact on drinking water supplies has not been well characterized. A number of studies have shown that carbon particles coated with bacteria frequently penetrate treatment barriers and enter potable water supplies. The significance of bacteria released from GAC filters is unclear. Sand and anthracite carbon particles, as well as granular activated carbon (GAC) and powdered activated carbon (PAC) are filter materials released from treatment plants. Documentation of bacterial numbers in carbon adsorbers and in treated effluents is difficult to compare because of the variety of microbiological methods that have been used. Methods used to recover coliform bacteria in water from carbon filters may impact recovery efficiencies. Encouragement of bacterial growth on GAC media has been reported to increase the capacity of GAC filters for organic carbon removal, prolong bed-life of filters, remove nutrients for bacterial regrowth, and lower the chlorine demand of distribution water supplies. The role of bacterial antagonism on GAC has indicated that this phenomenon may be an important barrier to transport of pathogens into drinking water supplies. Studies have shown that bacteria attached to GAC were highly resistant to chlorine disinfection, but monochloramine may be valuable for the control of bacterial problems in GAC-treated water. Research needs to focus on maximizing the benefits of activated carbon, while minimizing its hazards. (See also W91-06194) (VerNooy-PTT)
W91-06199

MICROBIOLOGY AND DRINKING WATER FILTRATION.
Environmental Protection Agency, Cincinnati, OH.
G. S. Logsdon.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 120-146, 1 fig, 3 tab, 53 ref.

Descriptors: *Drinking water, *Filtration, *Microbiological studies, *Microorganisms, *Water analysis, *Water quality, *Water treatment, Bacteria, Coagulation, Diatomaceous earth, Giardia, Literature review, Monitoring, Sand filters, Testing procedures, Viruses, Water quality control.

Reducing the risk of waterborne disease has been a goal of microbiologically related filtration research for nearly 100 years. This literature review summarizes that research and discusses the results of recent investigations. Numerous studies involving diatomaceous earth filtration, slow sand filtration, and coagulation and filtration are reviewed. All of the treatment processes considered can remove viruses, bacteria, and Giardia cysts from raw water with proper facility design, necessary maintenance and appropriate operational procedures. Filtration plant performance can be evaluated by a number of methods, including turbidity, particle count by electronic instrument, total microscopic count of bacteria, microscopic analysis of particulate count from cartridge filters, and analysis for viruses, bacteria, or protozoan cysts. The need for additional work at full-scale plants that display lower-than-expected microorganism removals is apparent. Plant performance can be improved by conducting a thorough evaluation of facilities and operating procedures, and then implementing changes that are needed. The results of numerous studies conducted over the decades indicate that water filtration plants can be effective barriers to the passage of microorganisms into finished drinking water. (See also W91-06194) (VerNooy-PTT)
W91-06200

HOME TREATMENT DEVICES AND WATER QUALITY.
Environmental Protection Agency, Cincinnati, OH.
E. E. Geldreich, and D. J. Reasoner.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 147-167, 3 fig, 10 tab, 11 ref.

Descriptors: *Carbon filters, *Domestic water, *Filtration, *Microbiological studies, *Point-of-use water treatment, *Water quality, *Water treatment, Bacteria, Heterotrophic bacteria, Microorganisms.

Various studies have shown that home treatment devices that use a carbon filter are effective for the removal of contaminants in drinking water, including chlorine disinfectant residuals, as well as organic and particulate substances; but their effectiveness maybe short-lived. Filter cartridges need to be replaced at intervals, and the microbial quality of the filtered water is extremely variable, being a function of input water flora, service life of the filter, water temperature, and frequency of static water conditions. Individuals who consume water from a biologically active filter may suffer adverse health effects. Barrier filters or bound-resin disinfectant materials have been used to minimize these microbial growths. However, their effectiveness as a protection from waterborne pathogens in a contaminated water supply has not yet been evaluated. Amplification of the heterotrophic bacterial population in carbon filter treatment devices is of concern. If opportunistic pathogens are present in this microbial flora, their growth may reach an infective dose level for some individuals. Epidemiological studies are needed on water supplies that may have a high heterotrophic bacterial population (over 1,000 organisms per mL). However, the potential for adverse human health effects by the user population from ingestion of large numbers of heterotrophic bacteria in the product water appears to be low. In an effort to minimize the deterioration of water quality by point-of-use treatment devices, the user should apply the following recommendations: use the device only on a microbiologically safe water supply; after a prolonged quiescent period, the device should be allowed to run to waste for at least 30 seconds at full flow; change filter cartridges as recommended; and adhere to the manufacturer's maintenance recommendations and filter changing instructions. (See also W91-06194) (VerNooy-PTT)
W91-06201

DOMESTIC WATER TREATMENT FOR DEVELOPING COUNTRIES.
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
C. Chaudhuri, and S. A. Sattar.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 168-184, 4 tab, 80 ref.

Descriptors: *Developing countries, *Disinfection, *Domestic water, *Drinking water, *Rural areas, *Water quality, *Water treatment, Carbon filters, Chlorination, Filtration, India, Literature review, Microorganisms, Point-of-use water treatment, Sand filters.

Provision of adequate quantities of safe water for the growing population of the developing world has become a challenging task. Unfortunately, the wide-spread pollution of water has rendered readily accessible sources of water unsuitable for human consumption without some degree of treatment. The available technology for drinking water treatment that is suitable for developed countries and urban areas in the Third World is often inappropriate for villages and small communities in developing regions. Commercially available coagulant/flocculants and coagulation/flocculation aids

routinely used in urban drinking water treatment are not readily available in many parts of the developing world, with the possible exception of alum. Several indigenous substances, such as seeds from several types of plants and clays, may serve as low-cost alternatives, and slow sand filters are a desirable methods for pretreating water in rural settings in the developing world. Other alternatives include rice hull ash filters, the UNICEF filter using charcoal, and coal-based filtration/adsorption media. The popularity of point-of-use commercial devices for drinking water treatment is rapidly increasing in urban areas of many developing countries. Two commercial domestic water treatment devices in India are tap-attachable water filters and candle filters. Other devices include a tap-attachable ultraviolet water purifier and a series of three Zero-B (zero bacteria) water purifiers incorporating ion exchange technology. For the foreseeable future, the use of chlorine is likely to continue as the most appropriate form of drinking water disinfection in rural communities of the developing world because of its relatively low cost, residual effect and broad-spectrum of activity. (See also W91-06194) (VerNooy-PTT)
W91-06202

MICROBIOLOGY OF DRINKING WATER TREATMENT: RECLAIMED WASTEWATER.
Pretoria Univ. (South Africa). Dept. of Medical Virology.
W. O. K. Grabow.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 185-203, 2 tab, 28 ref.

Descriptors: *Bioindicators, *Drinking water, *Microbiological studies, *Wastewater analysis, *Wastewater renovation, *Wastewater treatment, *Water quality, *Water reuse, *Water treatment, Bacteria, Carbon filters, Chlorination, Coliforms, Epidemiology, Monitoring, Namibia, Pathogens, South Africa, Viruses.

A comprehensive analysis of the microbiological quality of water treated by two multiple-barrier reclamation systems in Namibia and South Africa has demonstrated that the direct reclamation of safe drinking water from wastewater is technologically feasible and economically competitive under certain circumstances. The safety of the directly reclaimed drinking water was confirmed by the failure to detect adverse health effects on consumers in detailed epidemiological studies over more than ten years. Research on the incidence and behavior of a wide variety of health-related microorganisms in the raw water, and in individual treatment processes revealed that routine quality surveillance of the final water and the efficiency of individual units is possible. Microbiological indicator tests are available for this purpose which are relatively simple, inexpensive, and fast. In the case of established multiple-barrier treatment systems where efficiency is known, a combination of indicators (consisting of the heterotrophic plate count, total coliform, and coliphages) is sufficient for routine quality surveillance. The final water and the water at one intermediary stage should have a heterotrophic plate count of less than 100 mL, and total coliform and coliphage counts of 0/100 mL. The treatment train should have at least one automatically controlled disinfection stage with a free chlorine residual of 1 to 2 mg/L for 1 to 2 hours at a pH of less than 8 and turbidity of less than 1 NTU. Routine microbiological quality surveillance procedures, which could be even faster and more convenient, should be investigated. Further research should also be conducted on the operation and control of activated carbon filters because they tend to serve as breeding grounds for a variety of organisms which may have health and other quality implications. (See also W91-06194) (VerNooy-PTT)
W91-06203

BACTERIAL DISTRIBUTION AND SAMPLING STRATEGIES FOR DRINKING WATER NETWORKS.
Centre des Sciences de l'Environment, Metz (France).
A. Maul, A. H. El-Shaarawi, and J. C. Block.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 207-223, 5 fig, 2 tab, 17 ref.

Descriptors: *Bacterial analysis, *Drinking water, *Microbial transport, *Pollutant identification, *Sampling, *Water analysis, *Water conveyance, *Water sampling, *Water treatment, Mathematical models, Microbiological studies, Monitoring, Spatial distribution, Statistical analysis, Temporal distribution, Water quality.

Some basic bacteriological and statistical issues involved in the design of sampling strategies for monitoring the health of a drinking water network both spatially and temporally are discussed. The origin and characteristics of the dispersion patterns of bacteria in a water distribution system are examined. Appropriate mathematical models, in terms of a probability distribution, are considered for representing the dispersion of bacteria in water. The parameters of these models and the general configuration of bacterial heterogeneity in the network is then used to assist in designing sampling programs for monitoring the microbiological water quality. Two different sampling designs are developed: sequential sampling and the one-run sampling design. The one-run design allows an 'instantaneous' assessment of the water quality in the system. In both cases, emphasis is laid on the risk of sampling (i.e., making the wrong decision). (See also W91-06194) (VerNooy-PTT)
W91-06204

INVERTEBRATES AND ASSOCIATED BACTERIA IN DRINKING WATER DISTRIBUTION LINES.
Millipore Corp., Bedford, MA.
R. V. Levy.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 224-248, 1 fig, 2 tab, 88 ref.

Descriptors: *Bacterial analysis, *Disinfection, *Drinking water, *Invertebrates, *Water conveyance, *Water quality, *Water quality control, *Water treatment, Bacteria, Chlorination, Filtration, Microbial transport, Monitoring, Pipelines, Pollutant identification, Reviews.

The occurrence and persistence of invertebrates in public drinking water supplies is a common complaint concerning both unfiltered and filtered water supplies and distribution systems. These invertebrates include crustaceans (amphipods, copepods, isopods, ostracods), nematodes, flatworms, water mites, and insect larvae such as chironomids. The invertebrates may harbor and protect bacteria from disinfection with chlorine and monochloramines at concentrations normally present in distribution systems, even when the invertebrates are completely inactivated. Control of invertebrates within the reservoir and distribution system should be accomplished by selective use of the following methods: site evaluation; chemical control, e.g., copper sulfate, pyrethrins, and disinfectants; and physical control such as filtration of source waters, hydrant flushing, cleaning and relining of pipes and elimination of dead ends and areas of low flow. Since larger invertebrates such as isopods and amphipods and fly larvae can colonize distribution systems, they should be located using hydrant sampling or by using fiber optic examination of pipelines, removed physically, or killed within the system by hydraulic isolation of infestation areas followed by superchlorination or other chemical treatment of suspected areas. The best approach to invertebrate control is the systematic elimination of these invertebrates before they pass into the distribution system and to eliminate them within the system by conscientious monitoring of drinking water and routine maintenance and upgrading of the distribution system. (See also W91-06194) (VerNooy-PTT)
W91-06205

BIOFILMS IN POTABLE WATER DISTRIBUTION SYSTEMS.
Montana State Univ., Bozeman. Inst. for Biological and Chemical Process Analysis.
E. van der Wende, and W. G. Characklis.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 249-268, 6 fig, 1 tab, 23 ref.

Descriptors: *Biofilms, *Disinfection, *Microbiological studies, *Potable water, *Water conveyance, *Water treatment, Bacteria, Chloramines, Chlorination, Coliforms, Microorganisms, Pipes, Polymers.

A biofilm is a layer of microorganisms in an aquatic environment held together in a polymeric matrix attached to a substratum. Biofilms accumulate in drinking water distribution systems primarily by growth at the expense of nutrients in the water. The biofilms are continuously seeded with planktonic organisms entering the system via breakthrough. Biofilm cells are generally less susceptible to disinfectants than planktonic cells. As a consequence, excessive viable cell numbers may accumulate in the bulk water from detachment of cells from the biofilm in areas where insufficient disinfectant residual is maintained. Certain disinfectants may have properties more conducive to controlling biofilm populations. Less reactive, more persistent compounds, such as chloramines, maintain a higher disinfectant residual throughout the distribution system and may penetrate the biofilm more effectively and, thus, control biofilm organisms better than free chlorine. However little quantitative information is available regarding disinfection kinetics in biofilms. (See also W91-06194) (VerNooy-PTT)
W91-06206

WATERBORNE GIARDIASIS.
CH Diagnostic & Consulting Service, Fort Collins, CO.
C. P. Hibler, and C. M. Hancock.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 271-293, 6 fig, 3 tab, 34 ref.

Descriptors: *Bacterial analysis, *Culturing techniques, *Giardiasis, *Human pathogens, *Microbiological studies, *Protozoa, *Water treatment, Chlorination, Disinfection, Filtration, Giardia, Human diseases, Parasites, Water quality.

Giardiasis has become increasingly important as a waterborne disease of humans over the past 20 to 25 years and currently is the most common cause of waterborne disease. Most of the US outbreaks of giardiasis between 1980 and 1983 were in communities using unfiltered, disinfected water, but some were in communities with filtration systems that were bypassed or malfunctioning and five occurred in communities with filtration systems that had inadequate treatment. Over the past 12 years, over 7500 water samples have been analyzed, taken from 361 municipalities in 30 states, three provinces in Western Canada, and throughout Puerto Rico. A total of 798/4423 samples studied (18%) had Giardia cysts present. There are no reliable procedures available to effectively isolate and culture the few Giardia cysts present in a sample. Techniques available probably fail to recover more than 50% of the cysts present. The source of contamination with Giardia cysts often is difficult to determine, although sometimes it is clearly human sewage, or wild or domestic animals. Research was conducted to determine the amount of chlorine and time necessary to inactivate the cysts of Giardia between 0.5 C and 5.0 C, over a pH range of 6 to 8. A table of Giardia CT (disinfectant concentration, C, in milligrams/L or ppm multiplied by contact time, T, in minutes) values at different temperatures and pH levels is presented. If filtration is not adequate in water treatment plants to remove 99.9% of the Giardia cysts or treatment is considered inadequate to prevent a risk of waterborne giardiasis, municipalities using chlorine as the biocidal barrier will need to introduce sufficient chlorine and/or increase the time of contact with chlorine to inactivate Giardia cysts. (See also W91-06194) (VerNooy-PTT)

W91-06207

OCCURRENCE AND CONTROL OF CRYPTOSPORIDIUM IN DRINKING WATER.
University of South Florida, Tampa. Dept. of Environmental and Occupational Health.
J. B. Rose.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 294-321, 2 fig, 13 tab, 85 ref.

Descriptors: *Cryptosporidium, *Drinking water, *Human pathogens, *Microbiological studies, *Parasites, *Protozoa, *Water quality, *Water treatment, Disinfection, Epidemiology, Filtration, Human diseases, Pathogens, Pollutant identification, Survival, Water analysis.

The importance of Cryptosporidium, a human pathogen, in water may be better defined by understanding the nature of the organism, the presence of Cryptosporidium disease in the population,and the occurrence of the organism in the environment. Cryptosporidium was not recognized as a pathogen until 1955, and studies on its environmental occurrence began in 1985. It is a protozoan parasite and has a life cycle similar to that of most coccidia. As more cases of cryptosporidiosis have been identified and documented, more insight has been gained into the illness, infectivity potential and prevalence of the disease. Many enteric pathogens may be present in sewage, and wastewater may contain varying numbers of Cryptosporidium oocysts. In order to detect low levels of oocysts in large volumes of water, filtration techniques have been developed; the overall recovery efficiency of the methods range from 9 to 59% and is highly influenced by water quality. Cryptosporidium is commonly detected in surface waters, however it is unknown what factors are associated with peaks of contamination which may be responsible for waterborne outbreaks. No detailed information is available on the efficiency of filtration for the removal of Cryptosporidium oocysts, as these types of investigations have just begun. In order to assess inactivation of Cryptosporidium, a measure of viability needs to be used. Parasite viability may be determined by using a bioassay in an animal model or by excystation. Cryptosporidium has the potential to cause major waterborne disease, and water treatment may not be reliably assessed based on the common indicators. Routine filtration and disinfection practices may not adequately control Cryptosporidium in water. (See also W91-06194) (VerNooy-PTT)
W91-06208

YERSINIA ENTEROCOLITICA IN DRINKING WATER.
Montana State Univ., Bozeman. Dept. of Microbiology.
D. A. Schiemann.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 322-339, 1 fig, 5 tab, 80 ref.

Descriptors: *Bacterial analysis, *Drinking water, *Enteric bacteria, *Human pathogens, *Pathogenic bacteria, *Pollutant identification, *Water treatment, *Yersinia, Bacteria, Culturing techniques, Epidemiology, Laboratory methods, Microbiological studies, Reviews, Water quality.

Until the late 1960s, the number of reported human isolates of Y. enterocolitica was very small, but within a few years it increased to thousands worldwide. The organism has been associated most often with gastrointestinal disease including enteritis, terminal ileitis, and mesenteric lymphadenitis. A review of the description and classification of the organism includes serotyping and bacteriophage typing. Various models and markers that have been described for identifying pathogenic strains of Y. enterocolitica include serotype, plasmids, animal models, in vitro virulence markers, outer membrane proteins and epithelial cell interactions in vitro. At least two of the species that have been separated from Y. enterocolitica as defined originally, Y. kristensenii and Y. frederiksenii, are not infrequently isolated from humans with some disease condition. The complex epidemiology of yersiniosis includes transmission from a swine reservoir to humans. There have been only a few episodes, each involving only a small number of individuals in which drinking water was identified as the source of infection with Y. enterocolitica. No selective enrichment procedures have been described specifically for isolation of Y. enterocolitica from water. A suggested method for isolation from water includes concentration of bacteria from water samples, pre-enrichment, selective enrichment and plating agar. (See also W91-06194) (VerNooy-PTT)
W91-06209

LEGIONELLA IN DRINKING WATER.
Pittsburgh City Water Dept. PA.
For primary bibliographic entry see Field 5A.
W91-06210

INJURY OF ENTEROPATHOGENIC BACTERIA IN DRINKING WATER.
Montana State Univ., Bozeman. Dept. of Microbiology.
A. Singh, and G. A. McFeters.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 368-379, 2 fig, 2 tab, 44 ref. National Institute of Allergy and Infectious Disease Public Health Grant AI 19089 and US Geological Survey Grant 14-08-0001-G1493.

Descriptors: *Bacterial physiology, *Drinking water, *Enteric bacteria, *Human pathogens, *Microbiological studies, *Pathogenic bacteria, *Pollutant identification, *Water treatment, Bacteria, Bacterial analysis, Culture media, Culturing techniques, Epidemiology, Injury, Laboratory methods, Public health, Stress, Water quality.

It is well documented that a sizable portion of the bacterial population in drinking water and sewage may be injured as a result of various stress factors. The injured cells are unable to grow in the presence of selective agents incorporated in the media commonly employed for their detection and enumeration. This can lead to a significant underestimation of the organisms and result in an inaccurate evaluation of the potential health risks. Exposure of enteropathogenic bacteria to stress factors in water induces sublethal lesions in a large proportion of the population. As a consequence, the cells become more sensitive to the selective agents and show either reduction or loss of virulence. Prolonged exposure can lead to altered surface proteins, loss of virulence plasmids, and the synthesis of enterotoxins or induction of a dormant stage. All these processes have been shown to be reversible when the organisms are placed under more favorable conditions. The fate of injured organisms is determined by the nature of the environment in which they are placed after injury. The injured organisms that are already debilitated die rapidly in water at room temperature and in the presence of selective agents. However, these organisms can recover in a nonselective medium even at low nutrient concentrations and express undiminished virulence. Recovery from injury can also occur in the mammalian small intestine, and the time required for complete repair in vitro or in vivo may depend on the severity of the injury as well as the nature of the environment. Thus, the virulence potential of orally inoculated cultures is only slightly reduced or undiminished. The reduced virulence of parenterally inoculated or orally administered cultures may be due to the rapid nonimmune clearance of the injured organisms or to their inability to colonize the small intestinal epithelium. (See also W91-06194) (VerNooy-PTT)
W91-06211

VIRUSES IN SOURCE AND DRINKING WATER.
Arizona Univ., Tucson. Dept. of Nutrition and Food Science.
C. P. Gerba, and J. B. Rose.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 380-396, 5 tab, 64 ref.

Descriptors: *Drinking water, *Enteroviruses, *Microbiological studies, *Pathogenic viruses, *Pollutant identification, *Viruses, *Water pollution sources, *Water treatment, Culturing techniques, Groundwater pollution, Human pathogens, Public health, Septic tanks, Water analysis, Water quality.

All warm blooded animals harbor enteric viruses which are excreted in fecal material and can find their way into the aquatic environment. Human enteric viruses are able to exist for extended periods in the environment and many may survive conventional water and wastewater treatment. While a direct association with the presence of virus in a water supply and illness has not been demonstrated for all enteric viruses, the presence of any of these viruses in drinking water should be considered a major health concern. More than 110 types of human enteric viruses have been identified, including the enteroviruses, hepatitis A virus, Norwalk virus, reovirus, rotavirus and adenovirus. Enteric viruses can be expected to occur in any surface water exposed to contamination by human fecal wastes, while the most frequently reported source of contamination in outbreaks involving groundwater is overflow or seepage of sewage from septic tanks. The development of field concentration methods was a major factor in the increased isolation of enteric viruses from drinking water, but laboratory innovations in the propagation and enumeration of viruses such as rotavirus and hepatitis A virus have also contributed significantly more sensitivity to virus detection. Most of the enteroviruses are readily isolated and quantitated by either observation for characteristic viral cytopathogenic effects in the tissue culture or by the observation of plaques, or areas of cell destruction in a monolayer of cells. If it is assumed that all of the nonbacterial gastrointestinal illness being reported has a viral etiology, than as much as 64% could have been related to the presence of viruses in water. By conservative estimations only a small percentage of the waterborne outbreaks are ever detected or reported. Thus there is probably significantly more illness in the population due to viral contamination than is recognized. (See also W91-06194) (VerNooy-PTT)
W91-06212

PRESENCE-ABSENCE TEST FOR MONITORING DRINKING WATER QUALITY.
Ontario Ministry of the Environment, Rexdale. Lab. Services Branch.
J. A. Clark.
IN: Drinking Water Microbiology: Progress and Recent Developments. Springer-Verlag New York, Inc., New York. 1990. p 399-411, 5 tab, 19 ref.

Descriptors: *Bacterial analysis, *Drinking water, *Microbiological studies, *Pollutant identification, *Presence-absence test, *Water analysis, *Water conveyance, *Water quality, *Water treatment, Analytical techniques, Bacteria, Bioindicators, Coliforms, Culturing techniques, Laboratory methods, Membrane filters, Microorganisms, Monitoring, Pathogenic bacteria, Testing procedures.

The value of the presence-absence test has been assessed by many years of comparative analyses with the membrane filer technique. For the most part, the P-A test produced a higher number of positive tests, demonstrating greater sensitivity for detection of coliforms than the membrane filter (MF) test. Identification of other indicator bacteria detected and tabulation of their frequencies in different combinations showed an association with pollution levels as determined by MF coliform counts and the rate at which a P-A test became positive. P-A bottles producing a strong acid reaction and vigorous production of gas or foam in the medium invariably proved to have coliforms present as shown by later confirmation tests. Identification of individual cultures of indicator bacteria from raw and drinking water samples showed E. coli predominated in raw water and E. cloacae in drinking water. Monitoring drinking water quality by P-A test was initially done in conjunction

with MF tests to provide a quantification and comparison of coliforms in any sample found to show pollution. Recent work has suggested that if frequency-of occurrence monitoring were given official status for determining drinking water quality, the P-A test or any variations thereof might be appropriate for accurately estimating coliform frequencies in a water supply. Implementation of frequency-of occurrence monitoring would permit the continuance of MF or MPN (most probable number) procedures for water quality testing without the emphasis on coliform densities in individual samples. This new monitoring method would also foster the development of new analytical techniques which could take advantage of the presence-absence concept to automate or simplify microbiological methods for determining water quality within distribution systems. (See also W91-06194) (VerNooy-PTT)
W91-06213

STATISTICAL APPROACHES TO MONITORING.
Illinois Inst. of Tech., Chicago.
For primary bibliographic entry see Field 5A.
W91-06214

MICROBIOLOGICAL METHODS AND MONITORING OF DRINKING WATER.
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W91-06215

MONITORING HETEROTROPHIC BACTERIA IN POTABLE WATER.
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5A.
W91-06216

ENUMERATION, OCCURRENCE, AND SIGNIFICANCE OF INJURED INDICATOR BACTERIA IN DRINKING WATER.
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W91-06217

CHEMICAL QUALITY OF DRINKING WATER IN BAHRAIN.
Ministry of Health, Manama (Bahrain). Public Health Directorate.
A. O. Musiager, and Z. A. Khunji.
Journal of the Royal Society of Health JRSHDS, Vol. 110, No. 3, p 104-105, 1990. 1 tab, 7 ref.

Descriptors: *Bahrain, *Chemical properties, *Drinking water, *Water quality, Bottled water, Desalinated water, Fluorides, Groundwater, Mineral water, Saline water, Sodium.

There are various sources of drinking water in Bahrain. Tap water is obtained from both ground water and desalinated water, which are blended and then chlorinated for disinfection. Other sources of drinking water are the private desalination plants (treated water) and bottled mineral water. The chemical quality of five types of water used for drinking purposes (tap, treated, aqua, mineral, and carbonated) were studied. The three main sources of drinking water are tap, private treated, and bottled. The findings revealed that tap water had the highest level of all chemicals studied (except silica) compared to other waters. The sodium level in tap water ranged from 100 to 545.9 mg/L, with an average of 309.4 mg/L. This average exceeds the drinking water standard as recommended by the World Health Organization (WHO) (200 mg/L), making this water unsuitable for hypertensive people. Average level of fluoride ranged from 0.28 mg/L in carbonated mineral water to 0.85 mg/L in tap water. The high usage of bottled mineral water for drinking purposes may deprive the public, especially the children, from one of the protective elements (fluoride) for dental caries. This disease is highly prevalent in Bahrain. A program to control chemical quality of drinking water in the country is highly recommended. (Mertz-PTT)
W91-06237

COMMUNITY SELF-FINANCING OF WATER SUPPLY AND SANITATION: WHAT ARE THE PROMISES AND PITFALLS.
Water and Sanitation for Health Project, Arlington, VA.
M. Yacoob.
Health Policy and Planning HPOPEV, Vol. 5, No. 4, p 358-366, December 1990. 18 ref.

Descriptors: *Cost allocation, *Cost repayment, *Wastewater treatment, *Water distribution, *Water supply, *Water treatment, Cost sharing, Costs, Developing countries, Economic aspects, Estimated costs, Water costs.

As a result of the debt crisis in developing nations and shrinking donor resources, the water supply and sanitation sector is increasingly orientated towards recovering some portion of the cost of system development from beneficiary communities. In some cases, full cost recovery, including capital costs, is the goal. Sustainable projects continue to be perceived as the major indicator of successful sector development. Community acceptance of responsibility for system operation, maintenance and management appears to be essential to sustainability. Creating this kind of capability in communities requires both significant time and resources. Willingness to pay, initially used as an indicator of community preferences for level of service, has become a measure of a community's hypothetical willingness and ability to bear the cost of operations and maintenance and/or system development. The methodologies used to establish willingness to pay are imprecise as predictors of actual behavior. In designing ways to implement cost recovery, donors and implementing agencies have adopted some strategies that endanger the time spent in developing community management capability and, thus, undermine system sustainability. In working towards an effective approach to cost recovery, there are several steps that should be considered: (1) separate the concept of willingness to pay from that of cost recovery; (2) develop and use a concept of affordability in cost recovery strategies; (3) develop criteria that will ensure cost recovery and community self-financing strategies are used only in appropriate situations; (4) eliminate new business development from the list of appropriate cost recovery techniques; and (5) develop creative ways to generate resources that are community-based and take advantage of existing institutions, skills and abilities. There is a need to understand all of the implications of cost-recovery strategies, and particularly to examine their impact on sustainability and building community capability. (Mertz-PTT)
W91-06244

FLOW IN DAMAGED PIPE NETWORKS.
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Ingenieria.
For primary bibliographic entry see Field 8A.
W91-06296

SLUDGE DEWATERING BY NATURAL FREEZE-THAW.
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5D.
W91-06430

INVESTIGATION OF SOL PROTECTION IN CHEMICAL CLARIFICATION.
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 5D.
W91-06440

IMPORTANCE OF FLOCCULANT PREPARATION FOR USE IN SOLID/LIQUID SEPARATION.
Stranco, Inc., Bradley, IL.
For primary bibliographic entry see Field 5D.
W91-06441

MEMBRANE SOFTENING: A TREATMENT PROCESS COMES OF AGE.
Stone and Webster Water Technology Services, Fort Lauderdale, FL.
W. J. Conlon, and S. A. McClellan.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 47-51, November 1989. 1 fig, 5 tab, 20 ref.

Descriptors: *Dissolved solids, *Filtration, *Membrane processes, *Membranes, *Reverse osmosis, *Water softening, *Water treatment, Cost analysis, Economic aspects, Operating costs, Pilot plants, Technology, Waste disposal, Water quality, Water treatment facilities, Water treatment wastes.

In 1976, a Florida-based equipment manufacturer conceived the idea of using modified reverse osmosis membranes as a substitute for lime softening to treat waters with low total dissolved solids (TDS). Not only would the membrane reject hardness, but it would also serve as a barrier to repel bacteria and viruses. Further, this membrane process would remove organics-related color without generating undesirable chemical compounds such as chlorinated hydrocarbons. Over the last ten years progress in the field of membrane softening technology has led to the development of membranes operating in pressure ranges of 75-250 psi. In addition, successfully completed pilot studies have demonstrated a superior-quality product water as a result of the use of a membrane softening process. The process has also been accepted by regulatory agencies as a viable water treatment alternative. While the process is competitive with conventional water treatment processes, it should be evaluated on a case-by-case basis. (Korn-PTT)
W91-06810

COST AND PERFORMANCE OF A MEMBRANE PILOT PLANT.
University of Central Florida, Orlando. Environmental Systems Engineering Inst.
J. S. Taylor, L. A. Mulford, S. J. Duranceau, and W. M. Barrett.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 52-60, November 1989. 12 fig, 6 tab, 20 ref.

Descriptors: *Cost analysis, *Membrane processes, *Membranes, *Pilot plants, *Trihalomethanes, *Water supply, *Water treatment, Construction costs, Economic aspects, Feedwater treatment, Florida, Groundwater, Operating costs, Organic compounds, Performance evaluation, Water quality, Water quality standards.

The cost and effectiveness of trihalomethane (THM) control and potable water production by a membrane process were investigated during a one-year project at Flagler Beach, Fla., where the feedwater was a highly organic groundwater. Results of the study showed that the membrane system could control the formation of THMs for an extended period of time, producing a finished water that exceeded quality and quantity requirements. In addition, the thin-film composite membranes were highly resistent to acid degradation. Construction and operating costs for a membrane plant at Flagler Beach would be about the same as for a conventional softening plant. However, the finished water would be of a superior quality. In addition, the membrane plant was observed to be less labor intensive and easier to operate than a softening plant. (Author's abstract)
W91-06811

EFFECTS OF ULTRAFILTRATION MEMBRANE COMPOSITION.
Illinois Univ., Urbana. Dept. of Civil Engineering.
J.-M. Laine, J. P. Hagstrom, M. M. Clark, and J. Mallevialle.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 61-67, November 1989. 7 fig, 4 tab, 19 ref. U. S. Environmental Protection Agency Cooperative Agreement 812582.

Descriptors: *Filter media, *Membrane processes, *Membranes, *Ultrafiltration, *Water treatment, Adsorption, Fouling, Organic matter, Particle size, Particulate matter, Permeability, Surface water, Total organic carbon, Turbidity, Water analysis, Water quality.

In a study of the dead-end ultrafiltration (UF) of an untreated surface water, the effects of different membrane materials and molecular-weight cutoffs (MWCOs) were evaluated in terms of several parameters. These parameters included the removal of total organic carbon (TOC) and turbidity, the development of permeate flux, the flux recovery after backflushing, and membrane fouling. Results of the investigation revealed that TOC levels decreased by about 40% following treatment. This decline in TOC values appeared to be independent of the membrane MWCO values investigated. Turbidity removal greater than 98% was found for all membranes tested. The rate of flux decline and the magnitude of flux recovery were found to vary significantly and were primarily dependent on the type of membrane material. The study also pointed out that a large fraction of organic matter found in surface water should pass through typical UF membranes and that one of the primary technical considerations in using these membranes should be the selection of membrane material. Although membrane surface charge and roughness can also be important in fouling, it is believed that the most important quality of the membrane material is its hydrophilicity. Relatively hydrophilic membranes were found to perform much better than relatively hydrophobic membranes. (Author's abstract)
W91-06812

ASSESSING HOLLOW-FIBER ULTRAFILTRATION FOR PARTICULATE REMOVAL.
Montgomery (James M.) Consulting Engineers, Inc., Pasadena, CA.
J. G. Jacangelo, E. M. Aieta, K. E. Carns, E. W. Cummings, and J. Mallevialle.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 68-75, November 1989. 11 fig, 2 tab, 28 ref.

Descriptors: *Drinking water, *Membrane processes, *Membranes, *Particulate matter, *Ultrafiltration, *Water treatment, Bacterial analysis, Bioindicators, California, Coliforms, Particle size, Pilot plants, Suspended solids, Turbidity, Water analysis, Water quality.

Membrane technology, including ultrafiltration (UF), is becoming increasingly popular as an alternative process in the drinking water treatment train. However, little information is available on the use of ultrafiltration for particulate removal from untreated drinking water. A pilot study was undertaken to evaluate the efficacy of membrane filtration for the removal of particulate material from two untreated water supplies in Northern California. The permeate produced by the hollow-fiber ultrafiltration module was assessed by monitoring various water quality parameters. The results of the pilot plant study revealed that low-pressure UF, using a hollow-fiber membrane module was effective in reducing turbidity, particle counts, suspended solids, and selected indicator bacteria in the two test waters. Large differences in raw water quality, as defined by variations in these parameters, did not appear to affect the final product water quality. In addition, increases in transmembrane flux did not adversely affect turbidity removal in one of the untreated waters. (Korn-PTT)
W91-06813

REMOVING VOCS BY MEMBRANE STRIPPING.
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
A. K. Zander, M. J. Semmens, and R. M. Narbaitz.
Journal of the American Water Works Association JAWWA5, Vol. 81, No. 11, p 76-81, November 1989. 6 fig, 4 tab, 16 ref. U. S. Environmental Protection Agency Grant R-815140-01-0.

Descriptors: *Air stripping, *Drinking water, *Membrane processes, *Membranes, *Volatile organic compounds, *Water treatment, Head loss, Henrys Law, Mass transfer, Model studies, Pilot plants, Water pressure.

The current study reports the results of a pilot study conducted to compare the performance of a membrane air-stripping system with that of packed-tower aeration for removing volatile organic chemicals (VOCs) from drinking water. Membrane air stripping involves the transfer of VOCs from water to air in response to a concentration gradient and is described, at equilibrium, by Henry's law. The process is dependent on a large contact area between the water and air phases resulting in the high rate of transfer of the volatile chemicals. The results of the investigation revealed that the mass transfer coefficients measured for the membrane system were generally more than an order of magnitude greater than those for the packed-tower system. In particular, lower volatility compounds such as bromoform were very efficiently removed by the membrane. In addition, water pressure drops across a membrane module were significantly less than the head loss typically observed in packed tower operations. The data obtained for the membrane system were also compared with a predictive model developed from chemical engineering literature and verified in the laboratory. The model was shown to reliably predict removal ratios in the pilot scale system for stripping factors (R) greater than 2. (Korn-PTT)
W91-06814

MICRONUCLEUS ASSAY IN ANODONTA CYGNEA FOR THE DETECTION OF DRINKING WATER MUTAGENICITY.
Pisa Univ. (Italy). Dipt. di Scienze dell'Ambiente e del Territorio.
For primary bibliographic entry see Field 5A.
W91-06827

OPTIMIZING PHYSICAL PARAMETERS OF RAPID MIX DESIGN FOR COAGULATION-FLOCCULATION OF TURBID WATERS.
National Environmental Engineering Research Inst., Nagpur (India). Water Engineering Div.
V. A. Mhaisalkar, R. Paramasivam, and A. G. Bhole.
Water Research WATRAG, Vol. 25, No. 1, p 43-52, January, 1991. 7 fig, 6 tab, 24 ref, append.

Descriptors: *Coagulation, *Flocculation, *Water treatment, Aluminum sulfate, Chemical coagulation, Design criteria, Mixing, Regression analysis, Turbidity.

Conventional water treatment usually begins with rapid dispersal of chemical coagulants into raw water followed by vigorous agitation. This process, commonly referred to as initial or rapid mixing, is influenced by several parameters, both physical and chemical. In order to determine optimal parameters for tank design, coagulant dosage, and mixing times; four container geometries, square with and without baffles and cylindrical with and without baffles, where used to treat suspensions of bentonite clay in distilled water to which 2% aluminum sulfate solution was used as a coagulant. Results showed that for each turbidity level and alum dose an optimum value for velocity gradient and time of rapid mix resulted in minimum residual turbidity. Using regression analysis an apparent aggregation rate constant relating velocity gradient and mix times for various water turbidities is derived which predicts conditions for the most rapid production of an ideal floc. The effect of container geometry was also evaluated on the basis of apparent aggregation rate constants and its value is maximum for the square baffled container. This suggests that the rapid mix container geometry exerts a strong influence on the rate of flocculation. (Doyle-PTT)
W91-06863

SURVEY OF SAUDI ARABIAN DRINKING WATER FOR TRIHALOMETHANES.
University of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
For primary bibliographic entry see Field 5A.
W91-06896

CHLORINATION OF DRINKING WATER AND CANCER.
Calcutta Municipal Corp. (India).
S. K. Bhattacharya.
Water Resources Journal, No. 164, p 22-25, March 1990.

Descriptors: *Carcinogenicity, *Chlorination, *Disinfection, *Drinking water, *Risk assessment, *Trihalomethanes, *Water treatment, Chlorine, Chloroform, Developing countries, Human diseases, Toxicity.

Chlorination of drinking water has been suggested as a cause of cancer in humans in view of the procarcinogenic effect of some of the chlorination by-products such as trihalomethanes. During chlorination of water supplies for disinfection, chlorine will react with ammonia, either present in the water or deliberately added, to form inorganic chloramines. Chlorine reacts with organic matter to form trihalomethanes (THMs) such as chloroform, which produced carcinogenic effects in laboratory animals. Bioassays on other THMs (dichlorobromomethane, dibromochloroforms, and tribromomethane) are inconclusive, and the only evidence of carcinogenicity is mutagenic activity in bacteria. In developing countries, if chlorination is abolished as a means of water treatment, then the risk of death from water-borne diseases will increase. The advantages and disadvantages of other methods of disinfection (ozonation, chlorine dioxide, and ultraviolet radiation) must be carefully considered before choosing these methods over chlorination. Ozonation and ultraviolet radiation produce no residuals and must be used in conjunction with other disinfectants. With on-site generation of chlorine dioxide increasing in popularity, chlorine dioxide is gradually replacing prechlorination in some countries. All other disinfectant alternatives are costlier than chlorination and this is a great disadvantage where finance of disinfection processes is a big constraint. (Geiger-PTT)
W91-06898

IDENTIFICATION AND DETERMINATION OF HALOGENATED HYDROCARBONS IN WATERS OF GALICIA (N. W. SPAIN) BY HEADSPACE GAS-CHROMATOGRAPHY.
Santiago Univ. (Spain). Dept. de Analisis Quimico y Bromatologia-Toxicologia.
For primary bibliographic entry see Field 5A.
W91-07013

5G. Water Quality Control

EVALUATING THE PERFORMANCE OF SLOW SAND FILTERS IN NORTHERN IDAHO.
Idaho Div. of Environmental Quality, Coeur d'Alene.
For primary bibliographic entry see Field 5F.
W91-05960

ANALYZING BIOFILM PROCESSES USED IN BIOLOGICAL FILTRATION.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W91-05961

DISINFECTION OF SEWAGE, STORMWATER AND FINAL EFFLUENT.
Acer Environmental, Stevenage (England).
For primary bibliographic entry see Field 5D.
W91-05968

APPLICATION OF WATER-QUALITY STANDARDS TO UK BATHING WATERS.
Saint David's Univ. Coll., Lampeter (Wales). Centre for Research into Environment and Health.
D. Kay, M. Wyer, A. McDonald, and N. Woods.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 436-441, October 1990. 1 fig, 31 ref.

Descriptors: *Bacterial analysis, *Coliforms, *Public health, *Recreation, *Swimming, *Water quality, *Water quality standards, England, Fecal coliforms, Wales.

Data obtained from 425 sampling locations in England and Wales during the 1987 bathing season were analyzed against a range of six water-quality standards used by European and North American agencies. The following order of relative stringency was established: EEC (European Economic Community) guide level > US Environmental Protection Agency > Toronto > Canadian Federal > Modified EEC standard > EEC imperative level. All European Community countries, at present abiding by the EEC imperative bacteriological standards of the bathing water directive, would experience a significant increase in noncompliance for the fecal coliform parameter if standards were altered from the current EEC imperative criteria to any of the existing alternative beach management standards. In the absence of agreed, consistent enumeration methodologies and stringent quality control procedures, significant scientific problems will be encountered in comparing environmental indicator enumeration across wide geographical regions, because the standards were designed differently. European standards determine compliance on the basis of single percentage compliance level and North American standards use a two component structure. (Feder-PTT)
W91-05970

DRINKING WATER DIRECTIVE AND PROPOSED WATER SUPPLY (WATER QUALITY) REGULATIONS FOR SCOTLAND.
Strathclyde Regional Council, Glasgow (Scotland). Water Dept.
E. G. Chambers, and L. A. Greene.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 469-473, October 1990. 6 ref.

Descriptors: *Drinking water, *Public health, *Scotland, *Water law, *Water quality standards, Water policy, Water quality, Water treatment.

The proposed Water Supply (Water Quality) Regulations 1989 for Scotland will establish a statutory basis for applying the European Community Directives relating to drinking water quality and the quality of surface waters abstracted for drinking water to Scottish waters. The most significant provisions are designed to ensure public accountability through the establishment of water-quality registers in the public offices of Scottish water authorities and the publication of annual water quality reports. Wholesomeness has been defined in terms of compliance with quality standards. The sampling, analysis and reporting requirements will be both onerous and costly to implement for most Scotish water authorities. Water-treatment training for managers and operators will be given high priority. Substantially higher levels of capital investment in the country's water supply, treatment and distribution systems will be necessary to achieve compliance. (Author's abstract)
W91-05974

CHADWICK CENTENARY LECTURE--A REVIEW OF TWO CENTURIES OF PUBLIC HEALTH.
World Health Organization, Geneva (Swiztzerland). Community Water Supply and Sanitation Unit.
M. A. Acheson.
Journal of the Institution of Water and Environmental Management JIWMEZ, Vol. 4, No. 5, p 474-483, October 1990. 22 ref.

Descriptors: *England, *Environmental sanitation, *Legislation, *Public health, *Sanitary engineering, Chadwick, Local governments, Public policy.

Sir Edwin Chadwick pioneered Britain's sanitary science. Chadwick's proposals for substituting small-bore, inexpensive, self-cleaning sewer systems, together with a constant supply of water as an alternative to intermittent supply and the large brick-lined tunnels for collecting of storm water and household wastewater, were rejected until 20 years after Chadwick had left public office. He also recognized the need for a radical reform in the local government before such engineering solutions could be introduced. He urged the unification of local government services, especially in London, and his view was that one competent public authority should be responsible for carrying water into houses and also for carrying fouled water out of houses and out of towns. There was virtually no local administrative system capable of being expanded or adapted and until the Public Health Act of 1848, catalyzed in part by the cholera outbreaks, there was no legislation which could induce change. The systems based on Chadwick's ideas played a major role in changing England from an unsanitary to a healthy country by the end of the century. (Author's abstract)
W91-05975

BACTERIOLOGICAL WATER QUALITY OF RECREATIONAL AREAS: J. PERCY PRIEST PARK, TENNESSEE.
Middle Tennessee State Coll., Murfreesboro.
For primary bibliographic entry see Field 5B.
W91-06020

EFFECTS OF RESERVOIR ENLARGEMENT AND OTHER FACTORS ON THE YIELD OF WILD RAINBOW AND CUTTHROAT TROUT IN SPADA LAKE, WASHINGTON.
Washington Cooperative Fishery Research Unit, Seattle.
For primary bibliographic entry see Field 2H.
W91-06029

MANAGEMENT AND STATUS OF JAPANESE PUBLIC WATERS.
Setsunan Univ., Neyagawa (Japan). Dept. of Civil Engineering.
T. Goda.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 1-10, 1991. 13 fig, 2 tab, 11 ref.

Descriptors: *Japan, *Water pollution control, *Water quality, *Water quality control, *Water quality standards, Agricultural runoff, Eutrophication, Fish farming, Red tide, Wastewater management.

From 1974 to the present, the water quality of public water bodies in Japan has improved with respect to certain hazardous substances. Environmental quality standards have been set, and the levels of compliance with these standards has improved dramatically during the 1970s. Environmental quality standards (EQSs) have been developed for designated water areas, while restrictions on hazardous wastes apply to all public water bodies. Enclosed bodies such as lakes, reservoirs, inner bays, and inland seas still suffer a heavy pollution load, and small and medium sized streams in cities still had low compliance ratios. Action has been taken on eutrophication since 1952, spurred by a problem on Honshu Island. By the late 1960s researchers has established relationships between the rate of primary production, chlorophyll-a, and the level of nutrients such as nitrogen and phosphorus. Recent studies have investigated the life-cycle of the red-tide organism, and are examining the effect of fish farming on algal blooms. Almost 75% of industrial wastewater is now recycled. Per capita availability of freshwater in Japan is comparatively low, and the construction of 530 dams, in addition to the 2393 dams already in operation, is planned. Irrigation effluents from paddy fields are a major factor which influence river water quality in Japan. The improvement of water quality is being addressed with several methods, including nutrient removal through plants, intermittent aeration, protection of wetlands, and control of pollutant loading. (Tappert-PTT)
W91-06039

RECENT DEVELOPMENTS IN WASTEWATER MANAGEMENT IN JAPAN.
Japan Sewage Works Association, Tokyo.
T. Kubo.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 19-28, 1991. 13 tab.

Descriptors: *Japan, *Legislation, *Wastewater, *Wastewater management, *Wastewater treatment, *Water quality control, Industrialization, Urbanization, Water pollution control.

Water quality in Japan has been declining since the late 1950s as a result of a remarkable rate of urbanization and rapid industrialization. Japan has experienced serious and tragic water pollution problems such as Minanata disease (mercury poisoning) in the 1960s. Laws were enacted in 1970 that addressed environmental pollution control, and since then effective countermeasures have been enacted. Establishment of a legislative framework, including the Basic Environmental Pollution Control (EPC) Law and the promulgation of Environmental Water Quality (EWQ) Standards, identified target environments and established water quality goals for specific environments. The Water Pollution Control (WPC) Act provided for enforcement of E (effluent) Standards on dischargers and establishes a surveillance and monitoring system, including spot inspections. The Sewerage Act encouraged the development of sewer systems and industrial pretreatment plants. Other legislation provided five-year plans for sewer construction, resulting in a rapid increase in the percentage of the population serviced by public sewer systems. Research and technology development for wastewater treatment techniques has increased, and wastewater reclamation and reuse policies have been implemented. Public awareness and education concerning wastewater treatment is an important part of water pollution control effort. (Tappert-PTT)
W91-06041

RIVER BASIN WATER QUALITY MANAGEMENT IN JAPAN - AN OVERVIEW.
Ministry of Construction, Tokyo (Japan). Dept. of Sewerage and Sewage Purification.
K. Murakami.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 29-39, 1991. 1 tab, append.

Descriptors: *Industrial wastewater, *Japan, *Legislation, *River basins, *Wastewater management, *Water pollution control, Regulations, River basin development, Water quality control.

Due to rapid industrialization and the concentration of the population shifting towards large cities starting from the 1950s, Japan experienced severe water pollution problems throughout the country. Lack of adequate sewerage systems was one of the major causes of severe water pollution. In an effort to curb these problems, a legal regulation system was developed in the late 1950s; two laws were passed in 1958 to regulate discharges to public waters. The current legal system was established around 1970. The Basic Law for Environmental Pollution Control was passed in 1967 and established basic policy for all types of pollution. The Water Pollution Prevention Law was enacted in 1970, and the Sewerage Law was amended in 1970 to serve as a master plan for the development of sewerage systems. Other laws were passed to address specific problems in inland seas, lakes, and rivers. Various measures to control water pollution have resulted from this legislation, including Environmental Water Quality (EWQ) Standards and effluent standards. As a result, water pollution control and river basin management programs have shown great progress in the last two decades. However, the stream BOD standard is not being met in about 30% of river reaches and the lake COD standard is not being met in about 60% of water areas, a clear indication that much more remains to be done. (Tappert-PTT)
W91-06042

STUDY OF THE PLANNING OF WATER POLLUTION CONTROL FOR SECOND SONGHUA RIVER IN CHINA.
Jilin Architectural and Civil Engineering Inst., Changchun (China). Dept. of Urban Engineering.
Y. Jun.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 41-48, 1991. 2 tab, 3 ref.

Descriptors: *Biochemical oxygen demand, *China, *Cost allocation, *Dissolved oxygen, *Water pollution control, Economic aspects, Industrial wastes, Model studies, Wastewater treatment.

From an economic point of view the Second Songhua River is the most valuable river for Jilin province, China. The middle and lower reaches of the river have been polluted to varying degrees by industrial wastewater and domestic sewage. The river has been studied using Thomas's BOD-DO stable model as the initial structure on the basis of previous investigations and analyses performed on every reach. Because the Second Songhua River is a northern river, values for oxygenation and sedimentation coefficients in the dry season of winter were determined and calculated, and a series analysis made. The self-purification ability of the river and the total elimination amount of the main pollutant BOD5 were also calculated. In order to minimize the required cost of controlling the pollution, the cost was distributed to the main pollution sources, which are subject to control. A cost function of a sewage treatment plant was determined by series design, and the related cost parameters were calculated. Two kinds of optimal distributing models of BOD elimination were evaluated, including a mathematical model of extreme value of conditions and a matrix mathematical model. The models are being used to develop a practical pollution control plan for the river. (Tappert-PTT)
W91-06043

RIVER BASIN MANAGEMENT IN THE UK.
Middlesex Polytechnic, Enfield (England).
For primary bibliographic entry see Field 6E.
W91-06045

WATER QUALITY MANAGEMENT IN THE YODO RIVER BASIN--CASE STUDY.
Setsunan Univ., Neyagawa (Japan). Dept. of Civil Engineering.
T. Goda, and H. Nakanishi.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 65-74, 1991. 6 fig, 16 tab, 18 ref.

Descriptors: *Japan, *Water pollution control, *Water pollution sources, *Water quality standards, *Water reuse, Biological oxygen demand, Case studies, Chemical oxygen demand, Model studies, Nitrogen compounds, Pollution load, Runoff, Wastewater facilities.

The Yodo River in Japan was selected as a case study to investigate an appropriate sewage treatment system to be applied in a river basin where river water is re-used repeatedly. The river has a catchment area of 8,240 square kilometers and a population of ten million. Many sewage effluent outfalls discharge into the river upstream from intake points for drinking water. Water quality parameters were modeled with data collected from eight sampling points on the river and its tributaries. Water quality during low flow conditions was considered appropriate for the achievement of environmental water criteria. Conclusions of the study include: (1) investigations of chemical oxygen demand (COD), ammonia-nitrogen, and trihalomethane development potential are necessary in polluted rivers used as drinking water sources, (2) the effect of constructing a sewage treatment system on river water conservation should be evaluated with the predicted water quality in the low flow and average flow condition, (3) time and place variations of the ammonia-nitrogen concentration in the Yodo River can be predicted by adaptation of a two-dimensional unsteady state diffusion model, (4) the greater part of total nitrogen or ammonia-nitrogen load deposited at the Yodo River branches in the dry weather condition are washed away by the wet flow condition, (5) it will be possible to maintain the present water quality level for TN and ammonia-nitrogen in the treatment system, and (6) an adaptation of an advanced sewage treatment system is recommended to enable re-use of river water as drinking water. (Tappert-PTT)
W91-06046

WASTE ALLOCATION MODELS FOR RISK ASSESSMENT OF WATER QUALITY MANAGEMENT IN A RIVER BASIN.
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
C. G. Wen, and S. Y. Fu.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 75-83, 1991. 4 fig, 13 ref.

Descriptors: *Stochastic models, *Taiwan, *Waste load allocation, *Water pollution control, *Water quality standards, *Watershed management, Pollution load, Tungkang River.

The degradation of water quality in rivers from various human activities is of increasing concern. In Taiwan, the lack of water quality data prevents the establishment of a cost-effective plan for the protection and maintenance of river quality. Both river flow and pollutant loading rates must be considered when developing water quality standards and allocating discharge load limits. A stochastic water quality management model is developed which considers river flow as a random variable and optimizes waste allocation at point sources. The model is subjected to a chance constraint which can be converted to an equivalent deterministic constraint, and then solved by the use of the available deterministic programming algorithm. The allowable discharge loads land degree of required removal of each point source of a river basin are optimized under various degrees of reliability, and can be employed as information for decision making to decide the most suitable treatment degree of wastewater in a river basin. When applied to the Tungkang River in Taiwan, the model proposes decreasing discharge load levels with higher reliability; as allowable biological oxygen demand is decreased, the reliability of the water quality predictions increases. (Tappert-PTT)
W91-06047

WATER QUALITY IN THE PRIORITY WATERCOURSES OF HONG KONG IN RESPECT OF VARIOUS ENVIRONMENTAL CONTROL MEASURES.
Hong Kong Environmental Protection Dept., Wan Chai. Water Policy Group.
K. C. Ho.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 85-91, 1991. 3 fig, 1 tab, 3 ref.

Descriptors: *Hong Kong, *Pollution load, *Regulations, *Water pollution control, *Water quality standards, Biochemical oxygen demand, Wastewater treatment, Water pollution sources.

Finding adequate supplies of freshwater has been a problem for Hong Kong since it was founded in 1841. Two-thirds of the 300 km of watercourses in the territories were found to be grossly contaminated in 1973, largely from livestock droppings, domestic sewage, and effluents from cottage industries. For this study the water quality in 12 priority watercourses was appraised with respect to the various environmental control measures being undertaken. Water quality in Lam Tseun River had been significantly improved since 1983. This improvement is attributed to recent sewer construction, management of the river basin to increase flow (including rechanneling and desilting), and declaration of the catchment as a 'Water Control Zone' under the Water Pollution Control Ordinance. In contrast with the other heavily polluted watercourses, for which few abatement measures were implemented, the water qualities of Shing Mun River and Tuen Mun River were slightly upgraded, due to efforts to stop unauthorized industrial discharges and the construction of interceptors and sewers. The 10 year Livestock Waste Control Scheme enforced on June 24, 1989 was found to correspond to a decrease in BOD and suspended solids concentrations in watercourses. To assess its effectiveness, a longer term monitoring program is required to confirm the apparent progress. (Tappert-PTT)
W91-06048

WATER DEMAND MANAGEMENT: AN EVALUATION OF A 'SOFT' SOLUTION FOR THE HAMILTON HARBOUR REMEDIAL ACTION PLAN.
Inland Waters Directorate, Burlington (Ontario). Water Planning and Management Branch.
R. Rivers, and R. Kalinauskas.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 105-109, 1991. 23 ref.

Descriptors: *Water conservation, *Water demand, *Water pollution control, *Water quality control, Hamilton Harbor, Lake management, User charges, Wastewater treatment, Water costs.

Hamilton Harbor is one of 42 Areas of Concern that were identified by the International Joint Commission of Canada and the United States as having a high degree of environmental degradation. Problems include contaminated sediments, severe eutrophication with algal growth, high metal concentrations and other contaminants in the water column, accumulated contaminants in fishes, widespread bacterial contamination, and a stressed biota. Proposed remedial activities for Hamilton Harbor has focussed largely on the traditional 'end of the pipe' solutions to the problems of municipal wastewater treatment. One 'at the source' solution, water demand management, would appear to be the single most cost-effective action for the remediation of the harbor. Fully developed relationships between volumes of water usage and the quality of sewage treatment facility effluent have not yet received an adequate degree of investigation. By making water more realistically priced, greater efficiency in the allocation and use of harbor water would be achieved. Pollutant loads would be reduced, consumers would be more educated about proper use of water, revenues would be raised to pay for water services and harbor cleanup, and the cost of water services would be more equitably distributed among water users. (Tappert-PTT)
W91-06050

HISTORICAL AND PRESENT DAY MANAGEMENT OF THE RIVER RHINE.
Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).
G. H. Broseliske, J. de Jong, and H. Smit.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 111-120, 1991. 4 fig, 5 tab, 16 ref.

Descriptors: *Rhine River, *Water pollution control, *Water quality management, *Watershed management, Agricultural runoff, Nutrients, Pollutants, Wastewater pollution.

The river Rhine has a long history of national and international river management as a result of its location in a densely populated and highly industrialized area. The river has undergone many changes in morphology, chemistry, and ecology due to the effects of human interference. The construction of dikes, locks and dams, and canals to control flooding and improve navigation have resulted in the dramatic decline of the floodplain and the drying out of what remains, the disappearance of diversity in sediments and flow velocity of the river itself, and the reduction of open connections to the sea. Major organic pollution began with the construction of municipal sewer systems and industry discharges to the river. Industrialization also led to heavy metal contamination. Urbanization and the expansion of agriculture led to an increase in nutrients flowing to the river. As a result, the river ecosystem has been impoverished in terms of diversity. The Rhine Action Program has been developed by an international commission to protect the Rhine against further pollution and improve current water quality in both the Rhine and the North Sea. Changes necessary to meet the final objectives of the Rhine and North Sea Action Programs include reduction of municipal and industrial discharges, reduction in the volume of nutrients flowing to the river, and reduction in the volume of air pollution in the Rhine Valley. The complexity and level of the present problems make it necessary to use an integrated problem approach and multinational decision making to ensure adequate future management of the river basin. (Tappert-PTT)
W91-06051

EFFECT OF WATER PURIFICATION ECOLOGICAL ENGINEERING ON THE CAO YANG ROUND CREEK.
Jiaotong Univ., Shanghai (China). Dept. of Applied Chemistry.
C. Wang, J. Cai, J. Jiaxin, S. Xu, and Y. Yu.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 121-131, 1991. 9 fig, 3 tab, 4 ref.

Descriptors: *Aquatic plants, *China, *Eutrophication, *Water pollution treatment, *Water quality control, *Water quality management, Aquatic environment, Ecosystems, Water hyacinth.

The eutrophication of water has become an increasingly prominent problem in scenic spots and urban waterways. The creation of artificial ecosystems, by planting various aquatic vascular plants with proper arrangements of time and space, is one approach to the problem of eutrophication. In 1986 approximately 500 m of the Cao Yang Round Creek was planted with a variety of aquatic plants, including floating plants, submerged plants, and standing plants. Cold weather plants and warm weather plants were planted in rotation. Water samples were collected twice monthly at fourteen sampling spots along the river. Sampling depths ranged from 15 cm to 35 cm below the water surface. The artificial plantings have formed an effective and stable ecological system for purifying water. Within two years, the water quality of Round Creek has been improved significantly. The density of algae (content of chlorophyll a) dropped by 95%, the total suspended solids decreased by more than 90%, and COD was reduced by 50%. The transparency of the water has increased from 15 cm before treatment to 53 cm after treatment. Some parts of the Creek are clear enough to see the bottom and count the fish. The artificial ecosystem has resulted in the improved water quality, clarity, and sightseeing value of the water body. (Tappert-PTT)
W91-06052

BEYOND THE DECADE: A GLOBAL FRAMEWORK FOR GLOBAL COOPERATION.
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
A. H. Rotival.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 211-213, 1991.

Descriptors: *Developing countries, *International agreements, *Water quality control, *Water quality standards, *Water treatment, Water management, Water supply.

The International Drinking Water Supply and Sanitation Decade (IDWSSD) was launched by the General Assembly of the United Nations in November 1980 with the goal 'to provide all people with water of safe quality and adequate quantity and basic sanitary facilities by 1990'. The World Bank estimates that despite the efforts during the Decade less than 50% of developing country populations have access to adequate water supplies and only 20% to adequate sanitation facilities. Major factors for the situation are the continuing population explosion and the economic stagnation of developing countries. Qualitative breakthroughs have been made, however, through (1) improved coordination for sector inputs at the global and country levels, (2) systematic formulation of country strategies, (3) rationalization of the management of the sector, and most significantly through (4) community involvement and (5) the adoption of low-cost sustainable and replicable technologies. The UNDP/World Bank Program and the UNDP/WHO Decade programs have played a catalytic role in developing activities in these five areas. To maintain Decade momentum beyond 1990 and to accelerate the provision of water supply and sanitation services to all, with emphasis on the unserved rural and peri-urban poor, by using a coordinated program 'Decade' approach, a Framework for Global Cooperation has been established. A series of meetings of a Collaborative Council of External Support Agencies (ESAs) is involved, leading to a global consultation in India in 1990 for all developing countries to define and achieve consensus on a water and sanitation strategy for 'Beyond the Decade.' (Author's abstract)
W91-06061

WATER QUALITY AND HEALTH (REVIEW OF THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE).
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 5F.
W91-06064

CASE HISTORY: MINIMATA MERCURY POLLUTION IN JAPAN - FROM LOSS OF HUMAN LIVES TO DECONTAMINATION.
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W91-06070

PRESENT SITUATION AND PROBLEMS RELATED TO MARINE OILY-WATER SEPARATING TECHNIQUES.
Ship Research Inst., Tokyo. Ship Equipment Div.
K. Watanabe, H. Yamanouchi, Y. Ueta, and O. Nagata.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 319-328, 1991. 13 fig, 3 tab, 6 ref.

Descriptors: *Bilge, *Cleanup, *Marine pollution, *Oily water, *Separation techniques, *Ships, *Wastewater treatment, *Water pollution prevention, *Water pollution treatment, Administrative regulations, Amino acids, Coagulation, Flocculation, Japan, Oil.

Merchant ships are required to be provided with oily-water separating equipment that meets the requirements of the International Performance Testing Standard A.393(x) prescribed by the International Maritime Organization (IMO), where the discharged oil contents of the effluent measured at the outlet of the equipment are controlled to 15 ppm or 100 ppm depending upon gross tonnage. Investigations have been undertaken to find international solutions centering on the Marine Environment Protection Committee of IMO to improve the service performance of oily-water separating equipment. In this study, performance of the existing oily-water separating equipment in Japan was investigated and a study on new oily-water separating techniques was conducted under laboratory conditions. Two conclusions were drawn: (1) because the engine room bilge in an actual ship contains suspended solids, detergents, and other materials in addition to fuel oil and lubricating oil, it is difficult to clear the discharged oil control requirement of 15 ppm at all times when relying on a gravitational separation system of multiple parallel plates and a filter-type coalescer, (2) The newly developed oily-water separating mechanism relying on oil flocculation and froth flotation has displayed its usefulness for oil water containing oil particles and suspended solids with a particle size smaller than 10 micrometers, and thus is promising for application to oily-water separating equipment designed to meet the 15 ppm discharge requirements. A single-liquid oil coagulant consisting of an amino acid derivative has been developed in Japan, and a 2% water solution of this substance has been tested. Oily-water separation can be carried out by adding the coagulant to engine-room bilge containing seawater, and then mixing them. (Author's abstract)
W91-06074

PEROXIDE PRE-OXIDATION OF RECALCITRANT TOXIC WASTE TO ENHANCE BIODEGRADATION.
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W91-06079

METHODS TO SET SOIL CLEANUP GOALS TO PROTECT SURFACE AND GROUND WATER QUALITY AT HAZARDOUS WASTE SITES.
Environmental Resources Management, Inc., Exton, PA.
A. Huggins, and M. D. LaGrega.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 405-412, 1991. 1 fig, 1 tab, 10 ref.

Descriptors: *Cleanup, *Hazardous waste disposal, *Site remediation, *Soil contamination, *Soil treatment, *Waste management, Case studies, Legal aspects, Risk assessment, Standards, Waste treatment, Water pollution control.

Hazardous waste management programs in the U. S. have focussed on the cleanup of sites to meet environmental standards and mitigate environmental and human health risks. The programs involve cleanup of abandoned sites as well as existing industrial facilities. In many cases the criteria for cleanup at these sites are based upon the protection of ground or surface water resources. Criteria can be based upon (1) background levels in the surrounding environment, (2) national or state standards set to protect surface and groundwater uses, and/or (3) site-specific standards based on risk assessment techniques. Methodologies for the derivation of cleanup goals in the U.S. vary between regulatory programs. Media-protection standards or trigger levels are the simplest to manage, but their appeal can be diminished if they lead to unnecessary cleanup activities. Such simple systems also fail to deal with any unique site characteristics or exposure patterns. Partly in response to such concerns, some U.S. programs depend upon risk assessment to set site-specific cleanup goals. Several cases using various approaches to developing cleanup goals have been studied. The additional technical resources required to develop risk assessment-based cleanup standards do not appear to be substantial when compared to the savings realized in preventing unnecessary cleanup and disposal. (Author's abstract)
W91-06083

EFFECT OF SURFACTANTS ON THE SORPTION PARTITION COEFFICIENTS OF NAPHTHALENE ON AQUIFER SOILS.
Air Force Academy, CO. Dept. of Civil Engineering.
J. Brickell, and T. Keinath.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 455-463, 1991. 4 fig, 1 tab, 10 ref.

Descriptors: *Adsorption kinetics, *Aquifer restoration, *Cleanup operations, *Groundwater pollution, *Naphthalenes, *Surfactants, Adsorption-desorption, Chemical reactions, Clay soils, Groundwater movement, Organic pollutants, Pump and treat method.

The efficiency of removing organic contaminants from groundwater aquifers by the pump and treat process is adversely affected by the retardation of the contaminant's mobility due tc adsorption onto aquifer material. The use of surfactants in conjunction with the pump and treat process has the potential for improving contaminant mobility by solubilizing the adsorbed contaminant. An experimental program was conducted to screen various types of commercially available nonionic and anionic surfactants for solubilizing adsorbed naphthalene from one type of aquifer soil. Two additional types of aquifer soils were obtained, and the surfactant mixture, Tween 20 and Aerosol AY-65, selected during the screening process was used at various concentrations for equilibrium desorption studies to quantify surfactant effects on naphthalene desorption. Equilibrium desorption studies showed that a 0.125 percent surfactant solution decreased the partition coefficient 65 percent compared with water alone for one soil type, while greater surfactant concentrations resulted in less effective mobilization. However, the same surfactant mixture markedly increased the partition coefficient when used with another soil type, and had negligible effects for the third soil type. It was shown that the clay mineralogy significantly influenced the effect of the surfactant. (Author's abstract)
W91-06089

SURFACTANT SOLUBILIZATION OF POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS IN SOIL-WATER SUSPENSION.
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
Z. Liu, S. Laha, and R. G. Luthy.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 475-485, 1991. 4 fig, 3 tab, 20 ref.

Descriptors: *Cleanup, *Path of pollutants, *Polycyclic aromatic hydrocarbons, *Soil contamination, *Soil water, *Sorption, *Surfactants, Adsorption kinetics, Anthracene, Dispersants, Phenanthrene, Pyrene, Solubility.

Polycyclic aromatic hydrocarbons (PAHs) are hydrophobic compounds readily sorbed onto soil; the addition of surfactants to soil-water systems may solubilize PAH compounds by incorporation of the PAH in surfactant micelles. The solubilization of anthracene, phenanthrene, and pyrene was evaluated in soil-water suspensions with several nonionic and anionic surfactants. The most effective surfactants were nonionic octyl and nonyl-phenylethoxylates with 9 to 12 ethoxylate units. At soil-water mass ratios of about 1:7 to 1:2, greater than 0.1% by volume surfactant dose was required in order to initiate solubilization, with doses of 1% by volume resulting in 70-90% solubilization. The soil-water partition coefficient for anthracene was reduced by two orders of magnitude with 1% by volume phenylethoxylate surfactant. The solubilization of anthracene, phenanthrene and pyrene in soil-water systems occurs at surfactant doses much greater than the clean water surfactant critical micelle concentration. A surfactant-soil solubilization coefficient is derived from the ratio of the observed aqueous solubility of PAH in the presence of surfactant to the specific sorption of PAH onto soil. The ratio is shown to be proportional to the difference between the surfactant dose and the effective critical micelle concentration in the presence of soil. Additional information is needed on the sorption characteristics of surfactants on soil in order to describe more fully the PAH-surfactant solubilization process. (Author's abstract)
W91-06091

ANAEROBIC BIOTRANSFORMATION OF PCE AND TCE IN GROUNDWATER: A COMPARISON OF EXPERIMENTAL DATA WITH NUMERICAL RESULTS.
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
M. Y. Corapcioglu, M. A. Hossain, and M. A. Hossain.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 525-534, 1991. 4 fig, 1 tab, 22 ref.

Descriptors: *Biodegradation, *Bioremediation, *Chlorinated hydrocarbons, *Dispersion, *Fate of pollutants, *Mathematical models, *Model studies, Anaerobic conditions, Chemical reactions, Groundwater pollution, Sensitivity analysis, Tetrachloroethylene, Trichloroethylene.

Chlorinated hydrocarbons enter soil and groundwater through accidents and leaks at chemical disposal sites. Bacteria transform the dissolved compounds into intermediate compounds, and finally to a final compound that may or may not be easily biodegradable. Biotransformation and transport of chlorinated hydrocarbons in a saturated column can be simulated by a sequential mathematical model. The model predicts the reductive dehalogenation of dissolved chlorinated aliphatics under anaerobic conditions. The conservation principles expressed in terms of quantification of physical, chemical and microbial processes lead to a system of nonlinear partial differential equations. When applied to the methanogenic biotransformation of tetrachloroethylene and trichloroethylene, the numerical results compare well with experimental data. Sensitivity analysis suggests the model is more sensitive to rate constants of parent compounds than intermediates. Mineralization of vinyl chloride to CO2 is significantly affected by relatively small changes in the depletion rate coefficient. Significant sensitivity of mass distribution to flow velocity and the dispersion coefficient was observed for all compounds. The degree of convective transport is dominated by the magnitude of flow velocity. The results of the model efforts indicate that the mathematical analysis of in situ biotransformation techniques would greatly improve the efficiency of aquifer recovery operations. (Tappert-PTT)
W91-06096

COSTS FOR REDUCING FARMERS' USE OF NITROGEN IN GOTLAND, SWEDEN.
Sveriges Lantbruksuniversitet, Uppsala. Inst. of Economics.
I. M. Andreasson.
Ecological Economics, Vol. 2, No. 4, p 287-299, 1990. 2 fig, 3 tab, 7 ref.

Descriptors: *Agricultural practices, Costs, *Agricultural runoff, *Cost analysis, *Economic aspects, *Nitrogen, *Permits, *Sweden, *Water policy, *Water pollution control, Agricultural chemicals, Cover crops, Crop production, Crop yield, Fertilizers, Hydrologic models, Income, Legal aspects, Livestock, Manure, Regulations, Social aspects, Water pollution sources.

On Gotland, a Swedish island in the Baltic, drinking water is polluted by nitrogen resulting from agricultural use. Costs were compared for the quota, charge, and permit market systems aimed at reducing farmers' use of nitrogen. The value of yield losses and income distribution effects were estimated for all three policy instruments. According to the empirical results, a permit market is the least costly, both to society and to the farmers. The social value of yield losses under the charge and permit market system corresponds to about 60% of the value of yield losses under a quota system. The income distribution effects are highest for a charge system when both fertilizer and manure are regulated. When only fertilizer is regulated the income distribution effects are highest for a quota system. The income distribution effects of a permit market are lowest for both regulations, and never exceed 60% of the system with the highest income distribution effects. This method should also be applicable to inputs other than nitrogen. If the quota, charge, and permit market systems are designed the same way as in this analysis, then the analytical results obtained for Gotland can be generalized to the agricultural sector in other regions. However, the empirical results are specific for each region and depend to a great extent on the variation in production technologies between farmers. (Doria-PTT)
W91-06107

CHEMICAL EMISSIONS FROM THE PROCESSING AND USE OF MATERIALS: THE NEED FOR AN INTEGRATED EMISSIONS ACCOUNTING SYSTEM.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
W. M. Stigliani.
Ecological Economics, Vol. 2, No. 4, p 325-341, 1990. 2 fig, 2 tab, 22 ref.

Descriptors: *Domestic wastes, *Environmental monitoring, *Environmental policy, *Farm wastes, *Industrial wastes, *Nonpoint pollution sources, *Water pollution control, Economic aspects, Political aspects, River basins, Social aspects, Toxic wastes, Waste disposal.

The need for a comprehensive emissions accounting system for environmentally harmful chemicals was investigated. Such a system requires the availability of economic statistics to complement environmental data. A classification scheme is suggested that identifies environmental emissions at particular stages in the life cycle of chemicals as they flow through the industrial economy. Emissions are categorized as point source emissions related to energy and industrial production, diffuse source emissions from agricultural production, and consumption-related emissions. The results of recent analyses suggest that in advanced industrial societies consumption-related and diffuse source emissions are becoming increasingly important sources of chemical pollution relative to point source emissions. Such sources are more difficult to regulate than are point sources, and our information base for identifying and quantifying the emissions is largely lacking. A more thorough understanding of the way our industrial system works with respect to chemical pollution is required. Studies in 'industrial metabolism' are recommended as a first step in seeking this understanding. Large river basins may be the ideal spatial unit for conducting most such studies. These studies should be complemented by strategies for reducing consumption-related emissions, a major component of which is emphasis on environmentally safe design of consumer products. (Author's abstract)
W91-06109

EFFECTIVE COST-SHARE RATES AND THE DISTRIBUTION OF SOCIAL COSTS IN THE ROCK CREEK, IDAHO, RURAL CLEAN WATER PROJECT.
Idaho Univ., Moscow. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W91-06116

FIELD EFFICACY OF VECTOBAC-12AS AND VECTOBAC-24AS AGAINST BLACK FLY LARVAE IN NEW BRUNSWICK STREAMS (DIPTERA: SIMULIIDAE).
New Brunswick Research and Productivity Council, Fredericton. Chemical and Biotechnical Services.
C. M. Riley, and R. Fusco.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 1, p 43-46, March 1990. 3 tab, 13 ref.

Descriptors: *Biocontrol, *Black flies, *Insecticides, *New Brunswick, *Vectobac, Canada, Larval growth stage, Mortality, Stream discharge, Streams, Water temperature.

The control of blackfly larvae using 2 aqueous suspension formulations of Bacillus thuringensis, serotype H-14 was evaluated in 6 trials on small and large sized streams in New Brunswick, Canada. Applications equivalent to 25 ppm (Vectobac-12AS) or 12.5 ppm (Vectobac-24AS) over a 1-min period resulted in 100% control of blackfly larvae up to 3 km downstream of the application point. Over the 6 trials, effective carry was seen to increase with increased stream discharge, which varied from as low as 0.8 cu m/min in the small stream to 108.6 cu m/min in the large stream. (Author's abstract)
W91-06120

LABORATORY EVALUATION OF LAGENIDIUM GIGANTEUM (OOMYCETES: LAGENIDIALES) IN WATER FROM CONTRA COSTA COUNTY, CALIFORNIA, MOSQUITO SOURCES.
Contra Costa Mosquito Abatement District, Concord, CA.
V. I. Kramer.
Journal of the American Mosquito Control Association JAMAET, Vol. 6, No. 1, p 79-83, March 1990. 1 tab, 20 ref.

Descriptors: *Aquatic fungi, *Biocontrol, *Lagenidium, *Mosquitoes, Ammonium, Bioassay, California, Chemical oxygen demand, Chemical properties, Conductivity, Contra Costa County, Dissolved solids, Hardness, Hydrogen ion concentration, Larval growth stage, Marshes, Molds, Mortality, Nitrogen, Pastures, Phosphates, Regression analysis, Rice fields, Salinity, Streams, Turbidity, Water quality.

Six bioassays were performed to evaluate the efficacy of the fungus Lagenidium giganteum against mosquitoes in water collected from 75 sources. The fungus infected larvae of 4 genera and produced >90% mortality in water from some of the creeks, artificial containers, and the wild rice field tested during 4 of the assays. There was no larval mortality due to the fungus in water from irrigated pastures or marshes. Water quality parameters associated with L. giganteum infection varied among the bioassays; low measurements of total dissolved solids, hardness, conductivity, chemical oxygen demand, ammonium nitrogen, phosphate, and sa-

linity were significantly correlated with fungal efficacy in one or more of the assays. Regression analyses selected total dissolved solids, hardness, chemical oxygen demand, ammonium nitrogen, and/or phosphate as the best predictors of larval mortality due to L. giganteum. Turbidity and pH were not correlated with fungal efficacy. (Author's abstract)
W91-06122

ENVIRONMENTAL ASPECTS OF STABILIZATION AND SOLIDIFICATION OF HAZARDOUS AND RADIOACTIVE WASTES.
For primary bibliographic entry see Field 5E.
W91-06124

IN SITU GROUTING OF SHALLOW LAND-FILL RADIOACTIVE WASTE TRENCHES.
Oak Ridge National Lab., TN. Chemical Technology Div.
For primary bibliographic entry see Field 5E.
W91-06157

HAZARDOUS AND INDUSTRIAL SOLID WASTE MINIMIZATION PRACTICES.
For primary bibliographic entry see Field 5E.
W91-06158

BIOMARKERS OF ENVIRONMENTAL CONTAMINATION.
For primary bibliographic entry see Field 5A.
W91-06176

REDUCING AGRICULTURAL PESTICIDE USE IN SWEDEN.
Environmental Protection Agency, Washington, DC. Nonpoint Sources Branch.
A. C. Weinberg.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 610-613, November/December 1990. 2 tab, 25 ref.

Descriptors: *Agricultural chemicals, *Agricultural practices, *Pesticides, *Sweden, *Water pollution control, International law, Legal aspects, Legal review, Pesticide residues, Pesticide toxicity.

Concern in Sweden about the adverse consequences of pesticide use is evidenced by the establishment in 1985 of an ambitious goal to lower the risks to health and the environment from the use of pesticides in agriculture. The goal was to reduce by half the amount of pesticides used in agriculture in five years from 4528 tons of active ingredient in 1985 to 2,250 tons in 1990. Farmers in the southern part of the country cultivate a wide range of crops, such as wheat, sugar beets, potatoes, oleiferous plants, and peas. Bread grain, coarse grain, and oleiferous plants are cultivated on the central plains. Farther north a larger proportion of acreage is in forage plants, with seed potatoes being grown on arable land. Because of Sweden's northern position, the country is spared many plants diseases and pests found farther south; this results in the use of less pesticides than elsewhere. All pesticides used in Sweden must be registered. The National Chemicals Inspectorate is also developing a new process to evaluate new and old pesticides with regard to risks, benefits, and needs. Residue samples taken from food and drinking water are being increased and new methods of analysis are being introduced. A number of approaches are being used to reduce the actual use of pesticides. Tests are being developed for pesticide spraying equipment. Pest forecasts and warning services are provided. Lower pesticide doses are recommended. A 20% price increase was introduced in 1986 on all pesticides used in agriculture. Financial subsidy programs promote organic farming. Other measures include planning the use of pesticides to minimize pollution, such as lessons on how to fill spreading equipment and how to spread pesticides for minimal environmental risk. As a consequence of the pesticide reduction goal set in 1985, consumption of pesticides for agricultural use in Sweden has declined significantly over the past five years. By the end of 1990, the 50% reduction goal should be met. (Mertz-PTT)
W91-06229

WATER RESOURCE PLANNING IN CANADA.
For primary bibliographic entry see Field 6E.
W91-06230

CHEMICAL QUALITY OF DRINKING WATER IN BAHRAIN.
Ministry of Health, Manama (Bahrain). Public Health Directorate.
For primary bibliographic entry see Field 5F.
W91-06237

SOAK-AWAY SYSTEMS AND POSSIBLE GROUNDWATER POLLUTION PROBLEMS IN DEVELOPING COUNTRIES.
Obafemi Awolowo Univ., Ile-Ife (Nigeria). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W91-06238

NATURAL RECOLONIZATION OF A CHRONICALLY OIL-POLLUTED MANGROVE SOIL AFTER A DE-POLLUTION PROCESS.
Montpellier-2 Univ. (France). Lab. d'Hydrobiologie Marine.
F. Martin, E. Dutrieux, and A. Debry.
Ocean & Shoreline Management OSMAE6, Vol. 14, No. 3, p 173-190, 1990. 10 fig, 1 tab, 36 ref.

Descriptors: *Cleanup operations, *Mangrove trees, *Oil pollution, *Recolonization, *Restoration, *Sediment contamination, Chronic pollution, Cleanup, Decontamination, Ecological effects, Fate of pollutants, Oil, Water pollution effects.

Accidental pollution is often massive and rapid. In contrast, chronic pollution consists of spills of small quantities of pollutants, but over a longer period of time. The experimental site was located on the east coast of Borneo Island, 80 km north of Balikpapan city. The site has experienced numerous changes since an oil refinery was constructed in 1975. The Senipah oil terminal collects the oil extracted from nearby production fields. The results of a restoration operation at a mangrove polluted by hydrocarbons we examined. This site was a swamp usually planted with Avicennia sp. mangroves but which was totally destroyed after chronic oil spills. A special program made it possible to prevent pollution of the site, and to bring in clean marine water, thereby assisting the natural cleansing. A first stage involved reducing pollution in the access channel by setting up an oil-collecting device at the end of the discharge pipe. Simultaneously, works designed to stop the oily water from flowing into the site were undertaken. A dike was built in order to stop the water from flowing between the study zone and the access channel. However, because the main discharge of water no longer existed, a 110 m long channel (de-pollution channel) had to be dug, which enabled the site to be regularly washed by clean saline tidal water. The natural recolonization of the site by small Avicennia plants began rapidly (3 months) once the restoration equipment was operational. The density and the growth of these small plants seemed to be more influenced by the substrate type than by the hydrocarbon concentrations in the soil. The results showed that fresh oil was the real cause of the mortality of small plants rather than the concentrations of a soil-aged product. In the case of chronic pollution, stopping the regular arrival of a pollutant can be sufficient to restore a site, and it is not necessary to consider costly cleansing and restoration operations. (Mertz-PTT)
W91-06266

SWAMPBUSTER IMPLEMENTATION: MISSED OPPORTUNITIES FOR WETLAND PROTECTION.
Environmental Law Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W91-06274

LOW-INPUT AGRICULTURE REDUCES NONPOINT-SOURCE POLLUTION.
Environmental Protection Agency, Washington, DC. Nonpoint Sources Branch.
A. C. Weinberg.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 1, p 48-50, January/February 1990. 10 ref.

Descriptors: *Agricultural chemicals, *Legislation, *Nonpoint pollution sources, *Water pollution control, *Water quality management, Agriculture, Environmental protection, Farm management, Fertilizers, Groundwater pollution, Leaching, Management planning, Participating funds, State jurisdiction, Water Quality Act.

Despite progress, agriculture continues to impose stress on the environment. There is a direct relationship found between nitrate leaching to groundwater and nitrogen fertilizer use rates. According to a 1986 national assessment of surface waters, nonpoint-source pollution is the most pervasive and among the most serious water quality problems remaining in the U.S. The most recent national legislative response to these nonpoint-source pollution problems is Section 319 of the Water Quality Act of 1987, which requires states to submit for Environmental Protection Agency approval a nonpoint-source assessment report and management program by August, 1988. Much of agriculture's emphasis in the past has focused on increasing output such as yield. Nonpoint-source management programs provide an opportunity for states to promote use of low-input agricultural approaches. The Water Quality Act also provides a variety of funding sources for implementing state management programs to supplement states' own resources and authorities of other federal agencies. Reduced-tillage cropping systems and improved pesticide and nutrient management are examples of low-input best-management practices that reduce unwanted outputs. State nonpoint-source management programs are a primary vehicle for promoting the use of low-input agricultural approaches. (Fish-PTT)
W91-06304

AGRICULTURE'S ROLE IN PROTECTING WATER QUALITY.
Office of Management and Budget, Washington, DC. Natural Resources Div.
S. Offutt.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 1, p 94-96, January/February 1990.

Descriptors: *Agriculture, *Environmental quality, *Farm management, *Government supports, *Groundwater quality, *Water pollution control, Agricultural chemicals, Biotechnology, Cost-benefit analysis, Economic aspects, Fertilizers, Legislation, Nonpoint pollution sources, Water pollution prevention, Water pollution sources, Water quality control, Water quality management.

With the budget for fiscal year 1990, a federal government initiative was launched to protect water resources from contamination by fertilizers and pesticides without jeopardizing the economic vitality of U.S. agriculture. Federal agencies will design water quality programs to accommodate both the immediate need to halt contamination, particularly of groundwater, and the future need to alter farming practices that may threaten the environment. Full, unearmarked funding of the initiative is critical, especially in its first year of the proposed five-year program. The farm community itself must devise and implement a pollution control plan, involving research and education to develop a set of best management practices that farmers will continue to use even if commodity prices rise significantly or input prices fall. In the future, an agriculture must be developed that does not depend upon environmentally-damaging fertilizers and chemicals, such as biotechnology alternatives. Some barriers to groundwater quality protection include formidable costs, the feasibility of crop diversification, and soil conservation tradeoffs between surface water and groundwater quality. Making a case on behalf of farmers will be increasingly difficult as every other segment of the population has shouldered more and more of the cost of all kinds of pollution prevention and abatement.

The bottom line is that farmers must recognize that there will indeed be costs to preventing water resource contamination and that it may well be their responsibility to accept those costs in moving quickly to meet society's demands for protection of environmental qualiiy. (Fish-PTT)
W91-06305

WILDLIFE AND FISH AND SUSTAINABLE AGRICULTURE.
Izaak Walton League of America, Decorah, IA.
A. Y. Robinson.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 1, p 98-99, January/February 1990.

Descriptors: *Agriculture, *Alternative planning, *Farm management, *Groundwater pollution, *Water pollution prevention, *Wildlife conservation, *Wildlife habitats, Agricultural chemicals, Balance of nature, Conservation, Cropland, Ecosystems, Herbicides, Insecticides, Natural resources, Natural use, Pesticides.

A national movement has begun toward low-input, sustainable, regenerative, or alternative agriculture, as conservationists, organic food proponents, and average farmers find that they have some concerns in common about groundwater, about health, and about net profits. This type of agriculture offers the best hope of reducing chemicals in water and food supplies and in the farmer's work environment, and the potential to improve the quality and quantity of habitat for fish and wildlife. The aim of sustainable farmers is to work with nature by maintaining healthy soil and plants, harnessing biological mechanisms like natural predators and seasonal rhythms that exploit pests' life cycles; and to use hands-on management and on-the-farm resources. Effective reduction of the need for chemicals is achieved by use of selected rotations and cover crops to maintain soil 'balance' and organic matter; by use of substitute legumes, careful manure management, and biological controls for chemicals; by cutting use of synthetic nitrogen to prevent possible disruption of soil biota and to save energy; by use of conservation tillage techniques; and by diversification of farm enterprise. Adherents of sustainable agriculture recognize that wildlife helps gage the health of local ecosystems and enriches the countryside with beauty and economic opportunity. A greater diversity of crops and increased cover on fields could benefit a wide range of animals, particularly grassland birds. Pesticides, insecticides, and herbicides damage the health of wildlife and their habitats. Prevention, not regulation, is the focus of regenerative agriculture, and should be supported and rewarded. (Fish-PTT)
W91-06306

NUTRIENT NEEDS.
Georgia Tech Research Corp., Atlanta.
For primary bibliographic entry see Field 3F.
W91-06398

OVERVIEW OF SEPARATION TECHNOLOGIES DEMONSTRATED BY THE EPA'S SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION (SITE) PROGRAM.
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5D.
W91-06437

IN-SITU EXTRACTION OF CONTAMINANTS FROM HAZARDOUS WASTE SITES BY ELECTROOSMOSIS.
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
A. P. Shapiro, P. C. Renaud, and R. F. Probstein.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 345-353. 5 fig, 11 ref.

Descriptors: *Cleanup procedures, *Electro-osmosis, *Hazardous wastes, *In situ treatment, *Soil contamination, *Wastewater treatment, Acetic acid, Clay minerals, Electrodes, Phenols, Porous media, Separation techniques.

A procedure was developed for the in-situ extraction of contaminants in solution from hazardous waste sites which involves displacing the contaminant by a harmless aqueous purge solution which is moved through the soil, together with the contaminant by electroosmosis. The dc electric field is set up through embedded porous electrodes. Laboratory experiments with compacted kaolin clay samples saturated with acetic acid with sodium chloride purge solution and phenol solutions with tap water purge solution demonstrated a high degree of removal of the contaminants. A theoretical model of the process, including ionic migration and diffusion, is in good agreement with the low energy costs shown by these experiments. (See also W91-06421) (Author's abstract)
W91-06444

IN-SITU TREATMENT OF SOILS CONTAMINATED WITH HAZARDOUS ORGANIC WASTES USING SURFACTANTS: A CRITICAL ANALYSIS.
Howard Univ., Washington, DC. Dept. of Chemical Engineering.
R. C. Chawla, M. S. Diallo, J. N. Cannon, J. H. Johnson, and C. Porzucek.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 355-367. 3 fig, 30 ref. Los Alamos National Laboratory Contract 9-X58-808U-1.

Descriptors: *Cleanup operations, *Decontamination, *Hazardous wastes, *In situ treatment, *Organic wastes, *Soil contamination, *Surfactants, Capillarity, Oil pollution, Sorption.

A review of the current state-of-the-art of surfactant-assisted in-situ washing of soils contaminated with hazardous organic compounds was conducted. Past work on surfactant-assisted in-situ washing of organic laden subsurface soils was primarily an extension of tertiary oil (surfactant flooding) recovery to in-situ soil washing. As a result of this, only the removal of nonaqueous-phase liquid contaminants held to the pores of subsurface soils by capillary forces was addressed. Because forces other than capillarity (e.g., sorption) can play a significant role in pollutant emplacement in subsurface soils, it is critical to address the removal of pollutants bound by such forces. A more fundamental understanding of contaminant removal mechanisms is critical to assess adequately the applicability and limitations of surfactant-assisted in-situ soil washing. Research is currently under way to assess the applicability and limitations of tertiary oil recovery based in-situ soil washing, to determine the extent of surfactant-assisted desorption of sorbed organic pollutants, and to test a new approach to surfactant formulations based on the detergency and solubilizing power of surfactant aqueous solutions. (See also W91-06421) (Author's abstract)
W91-06445

ELECTROACOUSTIC SOIL DECONTAMINATION PROCESS FOR IN-SITU TREATMENT OF CONTAMINATED SOILS.
Battelle Columbus Div., OH.
R. E. Hinchee, H. S. Muralidhara, F. B. Stulen, G. B. Wickramanayake, and B. F. Jirjis.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 369-382. 4 fig, 5 tab, 23 ref.

Descriptors: *Acoustics, *Cleanup operations, *Decontamination, *Electroacoustic techniques, *In situ treatment, *Soil contamination, Dewatering, Electro-osmosis, Heavy metals, Leaching, Oil pollution, Organic wastes, Separation techniques, Zinc.

An in-situ electroacoustic leaching process (ESD) was developed to remove hazardous wastes from contaminated soils. The electroacoustic soil decontamination process is based on application of a dc electric field and an acoustic field to contaminated soils to increase the transport of liquids through the soils. The dominant mechanism of the enhanced flow is electroosmosis. Electrodes, one or more anodes and a cathode, and an acoustic source are placed in a contaminated soil to apply the electric and acoustic fields. A parametric investigation in a clay soil contaminated with n-decane (organic) and zinc chloride (inorganic) showed that ESD increased mobilization of the decane and zinc. The limited decane testing made definitive conclusions about the feasibility of ESD for non-aqueous phase liquids treatment impossible; however, the zinc testing indicated that in-situ treatment may be feasible. Despite very limited optimization opportunities, zinc removals of up to 95% were achieved. The most likely ESD application for treatment of organics is to enhance the recovery of solvents and fuel oils, or more soluble polar organics. When used for removal of metal ions, ESD may be coupled with a more conventional pump-and-treat technology. (See also W91-06421) (Geiger-PTT)
W91-06446

IN-SITU HOT AIR/STEAM EXTRACTION OF VOLATILE ORGANIC COMPOUNDS.
Toxic Treatments (USA), Inc., San Francisco, CA.
P. N. La Mori.
IN: Solid/Liquid Separation: Waste Management and Productivity Enhancement. Battelle Press, Columbus, Ohio. 1990. p 385-395. 3 fig, 1 tab.

Descriptors: *Cleanup operations, *Decontamination, *Hot air extraction, *In situ treatment, *Separation techniques, *Soil contamination, *Steam extraction, *Volatile organic compounds, Chlorinated hydrocarbons, Steam.

A new technology for removing volatile organic compounds (VOCs) from soil injects hot air/steam into soil through two 5-ft-diameter counter rotating blades that are attached to drill stems. The soil is cleaned as the drill stems are advanced into and retreated from the ground. The evolved gases are trapped in a surface covering, and contaminants are captured aboveground via condensation and carbon absorption. The recovered contaminants can be reprocessed or destroyed. The results of the initial use of the commercial prototype show 95 to 99% removals of chlorinated VOCs from clay soils. The technology was able to achieve its goal of less than 100 ppm over 80% of the time in a blind test. The mass of material recovered in the condensate was conservative (89%) of the mass determined removed from the soil by chemical analysis and physical measurements. The technology also removed significant quantities (80%) of semivolatile hydrocarbons. Subsequent analysis identified potential mechanisms for removal of semivolatile components. Further testing is planned to evaluate these mechanisms. The process has not been found to cause undesirable environmental emissions as a result of its operation. Noise and air emissions during operation are below the limits set by regional environmental regulations in southern California. Soil hydrocarbon emissions during treatment are not increased from background before treatment. Soil adjacent to the treatment has not been found to have increased VOCs after the process is operated. Environmental emissions caused by operational problems can generally be cured without shutdown. (See also W91-06421) (Author's abstract)
W91-06447

MEMBRANE SEPARATION TECHNOLOGIES IN POLLUTION CONTROL: CASE HISTORIES.
Cartwright Consulting Co., St. Paul, MN.
For primary bibliographic entry see Field 5D.
W91-06460

SMALL CATCHMENT STUDIES OF MAN'S IMPACT ON FLOOD FLOWS: AGRICULTURAL DRAINAGE AND PLANTATION FORESTRY.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06491

EMERGING TECHNOLOGIES IN HAZARDOUS WASTE MANAGEMENT.

Georgia Inst. of Tech., Atlanta.
Developed from a symposium sponsored by the Division of Industrial and Engineering Chemistry, Inc., of the American Chemical Society at the Industrial and Engineering Chemistry Winter Symposium, Atlanta, Georgia, May 1-4, 1989. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. 402p. Edited by D. William Tedder and Frederick G. Pohland.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Symposium, *Toxic wastes, *Waste disposal, *Waste management, *Waste treatment, Industrial wastes, Municipal wastes, Water pollution effects.

A symposium was held in May 1989 on 'Emerging Technologies for Hazardous Waste Treatment.' Participants included a mix of politicians, government regulators, and interveners. Sessions were conducted on water technologies and management of solids and residues. The problems addressed ranged from municipal wastes, radionuclide control, and cytotoxic and biologically active hazards, to chemical contamination and degradation, and species migration in water, soils, and residues. Research topics covered the gamut from fundamental studies, the evaluation of significant analytical problems and species degradation mechanisms, to semipilot-scale testing of innovative management and treatment technologies. The dominant themes included reactive techniques for the destruction of chlorinated species and innovative methods for economically detoxifying large quantities of contaminated soils. One of the goals was to promote interaction between investigators who seldom encounter each other in order to promote better solutions to a number of longstanding problems. (See W91-06656 thru W91-06677) (White-Reimer-PTT)
W91-06655

MODELING ADVANCED OXIDATION PROCESSES FOR WATER TREATMENT.
Illinois State Water Survey Div., Champaign. Aquatic Chemistry Section.
For primary bibliographic entry see Field 5D.
W91-06662

DEGRADATION OF 2,4-DICHLOROPHENOL IN ANAEROBIC FRESHWATER LAKE SEDIMENTS.
Georgia Univ., Athens. Dept. of Microbiology.
J. Weigel, X. Zhang, D. Dalton, and G.-W. Kohring.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 119-141, 7 fig, 1 tab, 75 ref. DOE grant DE-FG09-86ER13614.

Descriptors: *Anaerobic bacteria, *Bioremediation, *Dichlorophenol, *Lake sediments, *Methanogenesis, *Phenols, Dechlorination, Hydrogen ion concentration, Nitrates, Sodium chloride, Sulfates, Temperature effects.

In methanogenic sediments the xenobiotic compound 2,4-dichlorophenol is transformed via reductive dechlorination into 4-chlorophenol, which then is sequentially converted via phenol to benzoate (under CO2 fixation), which via acetate/CO2/H2 is degraded finally to CH4 and CO2. This proposed sequence is based on determinations of accumulated intermediates and on end products in various enrichment cultures. It was concluded that each of the given sequential steps are catalyzed by different anaerobic microorganisms. Transformation of dichlorophenol occurs between 5 and 50 C exhibiting a linear response in the Arrhenius graph between 16 and 30 C. The subsequent transformation steps have similar temperature ranges, with the smallest range for the dechlorination of 4-chlorophenol (17 to 38 C). This dechlorination step apparently is the rate limiting step in the degradation chain of 2,4-dichlorophenol. It also is the most critical one, since accumulated 4-chlorophenol inhibits the other reactions. The pH-optimum for 2,4-dichlorophenol is around 8.5, whereas it is around pH 7.0 for 4-chlorophenol, phenol, and benzoate. Sulfate, nitrate and NaCl (above 2.5%) are inhibitory for the dechlorination. A fast growing 2,4-dichlorophenol dihalogenating, stable enrichment culture was obtained. The addition (0.1% inoculum tested) of this culture to sediments which previously did not exhibit anaerobic dechlorination induced dechlorination of 2,4-dichlorophenol without a noticeable lag period. (See also W91-06655) (Author's abstract)
W91-06663

EVALUATION OF WOOD-TREATING PLANT SITES FOR LAND TREATMENT OF CREOSOTE AND PENTACHLOROPHENOL-CONTAMINATED SOILS.
Mississippi State Univ., Mississippi State. Forest Products Utilization Lab.
H. Borazjani, B. J. Ferguson, L. K. McFarland, G. D. McGinnis, and D. J. Pope.
IN: Emerging Technologies in Hazardous Waste Management. ACS Symposium Series 422. American Chemical Society, Washington, DC. 1990. p 252-266, 8 tab, 6 ref.

Descriptors: *Cleanup, *Creosote, *Hazardous wastes, *Pentachlorophenol, *Site remediation, *Soil contamination, *Waste treatment, Cores, Industrial wastes, Land treatment, Performance evaluation, Sludge, Wood wastes.

A study was conducted to evaluate the efficacy of land treatment as an on-site management alternative for waste sludges and contaminated soil containing pentachlorophenol and creosote from wood-treating facilities. During the first phase, the chemical and physical characteristics of the soil and waste sludges at eight wood-treating plant sites were evaluated. During the second phase, laboratory experiments were conducted to determine the potential for transformation of creosote compounds and pentachlorophenol in the site soils and to determine the potential for migration of these compounds in the site soils. Eight wood-treating plant sites in the southeastern U.S. were selected for study. A general history of treating operations at each site was taken, and the chemical, physical, and morphological characteristics of each site soil were determined. The soil and sludges were analyzed for seventeen creosote components (polynuclear aromatic hydrocarbons, PAHs), pentachlorophenol (PCP), and other chemical characterizations. Soil cores were taken for migration and degradation studies. The results indicate that PAHs and PCP can be transformed in soil at rates practical for land treatment. Based on the treatability data from soils tested to date, land treatment of creosote and PCP wood treating wastes appears to provide a viable management alternative for site remediation. The data variability does indicate the need for conducting site-specific treatability studies to discern the appropriate operation and management scenario for a given site. (See also W91-06655) (White-Reimer-PTT)
W91-06670

SOLVENT WASTE REDUCTION.
Environmental Protection Agency, Cincinnati, OH. Environmental Criteria and Assessment Office.
For primary bibliographic entry see Field 5D.
W91-06678

LAND AND LIQUID DISPOSAL BANS.
Environmental Protection Agency, Washington, DC. Office of Solid Waste.
For primary bibliographic entry see Field 5E.
W91-06679

WASTE MINIMIZATION LIABILITY ISSUES.
Latham and Watkins, Los Angeles, CA.
R. A. Wyman, and A. E. Register.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 18-29.

Descriptors: *Hazardous waste disposal, *Hazardous wastes, *Legal aspects, *Liability, *Waste disposal, *Waste reduction, Administrative regulations, Design standards, Economic aspects, Environmental law, Legislation, Waste treatment.

The legal incentives that the Hazardous and Solid Waste Amendment (HSWA) and related EPA regulations create to reduce hazardous waste production are addressed. Three compliance options available to hazardous waste generators and the liability associated with each are discussed: (1) source reduction; (2) recycling and resource recovery; and (3) treatment and land disposal. Although the HSWA waste minimization provisions require several certifications from the generator, legislative reports make it clear that these provisions are solely intended to encourage generators to voluntarily institute waste reduction programs on the basis of economic practicability. As such, the amendments require only that generators make a good faith effort to reduce wastes in light of individual circumstances. Several management options exist for a generator required to dispose of wastes in accordance with the HSWA land disposal and waste minimization requirements. However, greater liability risks are incurred. Because a generator faces continuing liability risks for hazardous waste releases, it should attempt to minimize these risks when dealing with transporters, recyclers, and treatment, storage and disposal facilities. A generator treating and disposing of wastes off-site will have to consider short-term and perhaps even permanent treatment capacity shortages that have resulted from implementation of the land disposal restriction and siting and permitting difficulties encountered by new facilities. Such shortages, along with more stringent design and construction standards for RCRA-approved landfills, are likely to drive up the costs of treatment and disposal significantly. (See also W91-06678) (White-Reimer-PTT)
W91-06680

MINIMIZATION OF PROCESS EQUIPMENT CLEANING WASTE.
Jacobs Engineering Group, Inc., Pasadena, CA. HTM Div.
C. H. Fromm, S. Budaraju, and S. A. Cordery.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 30-36, 3 tab, 1 fig.

Descriptors: *Cleaning wastes, *Hazardous waste disposal, *Hazardous wastes, *Solvents, *Waste disposal, *Waste reduction, Chemical cleaning, Costs, Deposits, Fouling, Process water, Toxicity.

A brief review of techniques, approaches, and strategies for minimizing equipment cleaning waste, and to provide a classification scheme that may serve as an initial guide to those interested in waste minimization is presented. The need for cleaning is a direct consequence of deposits formed on the surfaces exposed to the process environment. Generally, the need for cleaning can be reduced or avoided altogether by the application of the following measures: (1) inhibition of fouling or deposit formation rate; (2) maximizing dedication of process equipment to a single formulation or function; (3) proper production campaign scheduling; and (4) avoidance of unnecessary cleaning. When cleaning has to be performed, it should be performed effectively with minimal generation of waste. Typical considerations include the choice of cleaning medium, cleaning technique, and waste disposal option. The use of chemical cleaning (e.g., with mineral or organic acids) results in appreciable quantities of hazardous cleaning wastes which need to be treated before disposal. When chemical cleaning is unavoidable, the least toxic medium should be chosen. Costs of cleaning may vary widely depending on the medium, method, and application. (See also W91-06678) (White-Reimer-PTT)
W91-06681

SOURCE REDUCTION--PARTS CLEANING.
Parker and Amchem, Ambler, PA.
For primary bibliographic entry see Field 5E.
W91-06682

WHAT TO DO WITH HAZARDOUS WASTE: REGULATIONS, MANAGEMENT, AND DISPOSAL.

RECRA Environmental, Inc., Amherst, NY.
T. F. Stanczyk.
IN: Solvent Waste Reduction. Pollution Technology Review No. 193. Noyes Publications, Park Ridge, New Jersey. 1990. p 48-65, 12 fig, 7 tab, 5 ref.

Descriptors: *Hazardous wastes, *Regulations, *Waste disposal, *Waste management, *Waste reduction, *Waste treatment, Chemical wastes, Cost-benefit analysis, Costs, Priority pollutants, Solvents.

Source control strategies which are effective in reducing waste volumes are presented. Using categorical waste types, emphasis is on reduction strategies that are effective in eliminating and/or reducing chemical concentrations causing hazards and mobility concerns. Waste reduction audits quantifying feedstock usage and material flow must take into account individual constituents and their potential for being found in wastes as priority pollutants. Typical classifications warranting priority pollutant status are cyanides, photographic processing waste, phthalate esters, volatile organics, aliphatic hydrocarbons, and petroleum products. One of the source control strategies deals with the generator's policies and procedures for chemical feedstock procurement, storage, distribution, and usage. Some of industry's problems with excess waste generation occur from excess volumes of inventory, off-spec reagents, poor controls over purchasing and distribution, no accountability of ancillary process chemical usage, and basic lack of hazard awareness. Strategies are presented for waste minimization for metal-bearing wastes, heavy metal sludges, solvent-laden residues, packaged laboratory chemicals, and waste oils and oily residues. Both liquid-solid phase separation and stabilization-solidification can be used for waste reduction of hazardous materials. The cost/benefits associated with source control strategies are easily recognized. Disposal costs for services involving land disposal could conceivably triple over current prices by the mid-1990s. To sustain current price schedules for residues dictating land disposal through the 1990s, generators will need to achieve a 60 to 70% reduction in waste volumes. (See also W91-06678) (White-Reimer-PTT)
W91-06684

AQUATIC TOXICOLOGY AND RISK ASSESSMENT.
For primary bibliographic entry see Field 5C.
W91-06691

BIODEGRADATION AND REDUCTION IN AQUATIC TOXICITY OF THE PERSISTENT RIOT CONTROL MATERIAL 1,4-DIBENZ-OXAZEPINE.
Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD. Environmental Toxicology Branch.
For primary bibliographic entry see Field 5B.
W91-06696

REVIEW OF CHEMICAL FATE TESTING CONDUCTED UNDER SECTION 4 OF THE TOXIC SUBSTANCES CONTROL ACT: CHEMICALS, TESTS, AND METHODS.
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
For primary bibliographic entry see Field 5B.
W91-06697

NITROGEN MANAGEMENT AND GROUND WATER PROTECTION.
For primary bibliographic entry see Field 3F.
W91-06731

PROPER ACCOUNTING FOR N IN CROPPING SYSTEMS.
Agricultural Research Service, Lincoln, NE.
For primary bibliographic entry see Field 3F.
W91-06737

FERTILIZER NITROGEN MANAGEMENT.
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W91-06738

ESTIMATION OF N BUDGETS FOR CROPS.
Agricultural Research Service, Lincoln, NE.
For primary bibliographic entry see Field 3F.
W91-06739

IMPACT OF SOIL MANAGEMENT PRACTICES ON NITROGEN LEACHING.
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W91-06740

CROPPING SYSTEMS: ECOLOGY AND MANAGEMENT.
Minnesota Univ., St. Paul. Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W91-06741

MANAGEMENT OF WATER BALANCE COMPONENTS.
Agricultural Research Service, Fort Collins, CO. Northern Plains Area.
For primary bibliographic entry see Field 3F.
W91-06742

ECONOMICS OF NITRATE POLLUTION.
Stirling Univ. (Scotland). Dept. of Economics.
For primary bibliographic entry see Field 5C.
W91-06790

OFF-TARGET DEPOSITS AND BUFFER ZONES REQUIRED AROUND WATER FOR AERIAL GLYPHOSATE APPLICATIONS.
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
For primary bibliographic entry see Field 5G.
W91-06796

OFF-TARGET DEPOSITS AND BUFFER ZONES REQUIRED AROUND WATER FOR AERIAL GLYPHOSATE APPLICATIONS.
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
N. J. Payne, J. C. Feng, and P. E. Reynolds.
Pesticide Science PSSCBG, Vol. 30, No. 2, p 183-198, 1990. 4 fig, 4 tab, 26 ref.

Descriptors: *Forest management, *Glyphosate, *Herbicides, *Path of pollutants, *Pesticide drift, *Water pollution prevention, Application rates, Buffer zones, Environmental protection, Fish populations, Mathematical models, Salmon, Spraying, Trout.

Glyphosate is a broad-spectrum herbicide useful in managing forest weeds. Off-target deposit has been quantified from various silvicultural glyphosate application methods and an estimate made of the buffer-zone widths required around water to protect fish and their invertebrate food species from possible toxicological effects. To overcome the difficulty of estimating different buffer widths to meet the various use conditions encountered, a realistic worst-case scenario was chosen for small-drop drift and data were collected accordingly. Three glyphosate application methods were tested, employing a helicopter equipped with a 'Microfoil' boom, a 'Thru Valve Boom' and D8-46 hydraulic nozzles respectively. Airborne glyphosate and off-target glyphosate deposits on ground sheets and foliar surfaces were measured at downwind distances between 50 and 200 m from multiple overlaid crosswind swaths. Over this distance airborne glyphosate decreased by factors of 3 to 130, ground deposits by factors of 4 to 2200, and foliar deposits by factors of 5 to 100. In general, airborne glyphosate and off-target deposit was highest from the D8-46 application, and lowest from the 'Microfoil' boom application. Using these measurements, mathematical equations were formulated to predict glyphosate deposits on water surfaces downwind of multiple swath applications, and calculations made for 100-ha applications. Large-drop drift was also calculated using a ballistic model. An estimate was then made of buffer widths required around water bodies to prevent toxicological effects from small and large drop drift, using reported glyphosate toxicities to salmon, rainbow trout and various aquatic invertebrates. A buffer width of 25 m around water bodies limits mortality in populations of salmon, rainbow trout and aquatic invertebrates to less than 10% for the application methods employing the 'Microfoil' and 'Thru Valve Boom'. For the D8-46 hydraulic nozzle application method a 30 meter buffer width is suggested. (Author's abstract)
W91-06796

EVALUATION OF ULTRAVIOLET (UV)-OXIDATION TREATMENT METHODS.
Geraghty and Miller, Inc., Tampa, FL.
For primary bibliographic entry see Field 5D.
W91-06847

REDUCTION OF NITRATE LOADINGS TO GROUND WATER.
Maryland Univ., College Park. Dept. of Agricultural Engineering.
A. Shirmohammadi, W. L. Magette, and L. L. Shoemaker.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 112-118, Winter 1991. 4 fig, 2 tab, 24 ref.

Descriptors: *Groundwater pollution, *Leaching, *Maryland, *Nitrates, *Nonpoint pollution sources, *Path of pollutants, *Water pollution control, Barley, Farm management, Fertilizers, Model studies, Percolation, Runoff, Turf grasses, Water quality management, Watersheds.

Non-point source pollution of groundwater systems has become a national concern in recent years. Researchers and regulatory agencies are investigating the source and processes of the contamination. Agricultural best management practices (BMPs) traditionally developed to reduce non-point source pollution of surface water resources are being investigated for their impact on groundwater quality. The CREAMS (Chemical, Runoff, Erosion from Agricultural Management Practices) model was used to simulate the long-term effects of seven different BMPs on nitrate nitrogen (NO3-N) loadings to a shallow, unconfined groundwater system. Two representative watersheds, 5.8 and 8.9 hectares (14.3 and 22 acres) in area, in the Coastal Plain physiographic region of Maryland were selected for study. Soils in these watersheds belong to Matapeake silt loam series and have moderate infiltration capacity. Results from this study indicated the BMPs used in conjunction with winter cover (barley) reduced NO3-N leaching to the groundwater system. In addition turfgrass reduced surface losses of water and nitrogen, but increased leaching losses of water and NO3-N significantly. Thus turfgrass cultivation may be an economically viable farming business, but not a sound environmental practice considering groundwater quality impacts. All of the BMPs simulated in this study, however, resulted in leachate NO3-N concentrations exceeding 10 ppm, the U.S. EPA health standard for public drinking water, indicating a need for alternate practices for reducing nitrate leaching. (Author's abstract)
W91-06851

EVALUATING THE EFFECTIVENESS OF GROUND WATER EXTRACTION SYSTEMS.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
J. L. Haley, B. Hanson, C. Enfield, and J. Glass.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 119-124, Winter 1991. 1 fig, 1 tab, 8 ref.

Descriptors: *Cleanup, *Cleanup operations, *Groundwater extraction, *Groundwater pollution, *Water pollution treatment, *Wells, Evaluation, Fracture permeability, Groundwater quality,

Groundwater transport, Leaching, Plumes, Soil contamination, Superfund.

The most common method for remediating contaminated groundwater is extraction and treatment. Data from 19 on-going and completed groundwater and extraction systems were collected and analyzed by the U.S. EPA to evaluate the effectiveness of this process in achieving cleanup concentration goals for groundwater. This analysis indicated several trends including (1) containment of groundwater plumes was usually achieved; (2) contaminant concentrations dropped significantly initially followed by leveling out; (3) after a period of initial rapid decline, the continued decreases in concentration were usually slower than anticipated; and (4) certain data important to optimizing system design and operation had often not been collected during the site characterization phase. Factors limiting the achievement of cleanup concentration goals fell into four basic catagories; (1) hydrogeological factors such as subsurface heterogeneity, low-permeability units, and presence of fractures; (2) contaminant-related factors, such as high sorption to soil and presence of non-aqueous phases; (3) continued migration from source areas and the size of the plume itself; and (4) system design factors, such as pumping rates, screened intervals, and extraction well locations. While groundwater extraction has been shown to be an effective method for preventing additional migration of contaminant plumes and achieving risk reduction, it may not be practicable to rely solely on this method in order to achieve health-based cleanup concentrations. Several recommendations for improving groundwater response actions include: (1) contaminant plume containment should be initiated early; (2) the site characterization process should include collection of data on vertical variation of hydraulic conductivity, distribution of contaminant mass, and partitioning of contaminants to soil or a stationary phase in the saturated zone; (3) implementation in stages to better utilize information on aquifer response to remedial actions; (4) optimize system efficiency by monitoring and making modifications during remedial operations; and (5) consideration of methods to enhance effectiveness and efficiency. (Author's abstract)
W91-06852

METHOD FOR THE SAMPLING AND REMOVAL OF IONIC ALKYLLEAD COMPOUNDS FROM AQUEOUS SOLUTION USING ION EXCHANGE MEDIA.
Lancaster Univ. (England). Inst. of Environmental and Biological Sciences.
C. N. Hewitt, P. J. Metcalfe, and R. A. Street.
Water Research WATRAG, Vol. 25, No. 1, p 91-94, January, 1991. 1 fig, 2 tab, 21 ref.

Descriptors: *Ion exchange resins, *Lead, *Organometals, *Wastewater treatment, *Water pollution treatment, Adsorption, Analytical techniques, Atomic adsorption spectroscopy, Desorption, Gas chromatography, Heavy metals, Path of pollutants, Sampling, Sodium, Trace elements, Zeolites.

The synthetic resin Amberlite IR-120 in the Na(+) form (10 cu m), and the naturally occurring zeolite, clinoptilolite, (20 cu m) have been found to quantitatively remove trimethyllead (triML) from aqueous solutions of ionic strength up to 0.01 M NaCl. Elution by 150 cu m 2.7 M NaCl removes the TriML back into solution, from where it can be extracted, derivatized with propyl Grignard reagent and analyzed by GC-AAS. TriML is stable for at least 24 h on the ion-exchange media. The method allows the sampling and determination of TriML in natural and wastewaters within a detection limit of 0.1 ng (Pb) per cubic decimeter. It may also be used for the decontamination of wastewaters, provided that the NaCl concentration is less than 0.01 M. It is concluded that both Amberlite IR-120 in the Na(+) form and clinoptilolite can be used for the sampling and concentration of trace quantities of ionic alkyllead compounds. Clinoptilolite has equal performance, reduced costs, and requires less pretreatment than synthetic resin and is therefore, the preferred material for these applications. This technique may be applicable to other organometallic compounds, including tributyltin. (Doyle-PTT)
W91-06869

BIODEGRADABLE PLASTICS FROM POTATO WASTE DOUBLE SAVINGS TO ENVIRONMENT.
Argonne National Lab., IL. Environmental Research Div.
For primary bibliographic entry see Field 5D.
W91-06872

PROBLEMS AND REGULATIONS IN POLLUTION CONTROL IN THAILAND.
Office of the National Environment Board, Bangkok (Thailand). Natural Resources and Environmental Management Co-ordination Div.
S. Tridech.
Water Resources Journal, No. 164, p 27-33, March 1990. 3 tab, 9 ref.

Descriptors: *Regulations, *Thailand, *Wastewater treatment, *Water pollution control, *Water pollution effects, *Water pollution sources, Coliform bacteria, Domestic wastes, Effluent limitations, Industrial wastes, Molds, Monitoring, Viruses, Water law.

Water pollution is now considered to be a major problem in Thailand. The Chao Phaya River has been acting as a receiving water body for wastes from the domestic, industrial and farming sectors. Studies carried out on the bacteria in the canals introduced by domestic wastes showed populations of Salmonella typhi, S. paratyphi A, B and C, Shigella dysenteriae, Vibrio, Leptospira, and fecal coliforms, and various molds and viruses (infectious hepatitis virus A and polio virus). The Office of the National Environment Board (ONEB) has participated in the management and control of water pollution in natural water bodies, particularly in major rivers such as the Chao Phaya and the Thachin. Measures of combating water pollution include: establishing commercial and domestic effluent standards, monitoring water quality, controlling pollution at point sources, and establishing central wastewater treatment facilities for the Bangkok metropolitan area. ONEB acts as the main government agency for water pollution control. Implementing agencies that carry out water pollution control measures of the central government are the Departments of Industrial Works and Health, and public and local agencies such as the Bangkok Metropolitan Authority. The water quality standards and criteria related to the operation and control of wastewater treatment that are enforced in Thailand are: effluent standards, surface water quality standards, and requirements for environmental impact assessments. ONEB may authorize an expert to undertake a study of the adverse effects on environmental quality of a project or activity and submit a report of the study, with suggested preventive measures and remedies for such adverse effects. Environmental impact assessments are required before permits are granted to begin certain water-related projects. (Geiger-PTT)
W91-06899

MANAGING RESOURCES OF THE MURRAY-DARLING BASIN OF AUSTRALIA.
For primary bibliographic entry see Field 6B.
W91-06902

MINIMIZING MUNICIPAL LIABILITY UNDER NEW FEDERAL PRETREATMENT REGULATIONS.
Zorc, Risseto and and Weaver, Washington, DC.
For primary bibliographic entry see Field 5D.
W91-06912

PENNSYLVANIA'S SUPERFUND LAW AND GROUNDWATER MANAGEMENT.
Reed, Smith, Shaw and McClay, Harrisburg, PA.
F. L. Kury.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 24, No. 1, p 14-16, January/February 1991.

Descriptors: *Groundwater management, *Groundwater quality, *Hazardous waste disposal, *Pennsylvania, *Superfund, *Water pollution prevention, Cleanup, Drinking water, Groundwater pollution, Liability, State jurisdiction, Water law.

In 1988, the Pennsylvania legislature enacted the Hazardous Sites Cleanup Act (Act 108) which focuses on the prevention of contamination of groundwater. The Act grants the Pennsylvania Department of Environmental Resources (DER) broad investigatory powers to access sites and potential threats to surface or groundwater. Act 108 emphasizes early detection of water contamination through monitoring and analysis of drinking water if it is within 2,500 feet of a commercial hazardous waste storage, treatment, or disposal facility. Interim and permanent remedial responses to releases and threatened releases are authorized by Act 108. Responsible persons may be liable for water supply cleanups regardless of fault. Transporter liability may be imposed on hazardous substance transporters if they select and use a disposal or treatment site where contamination occurs. If a responsible person willfully fails to carry out response measures ordered by the DER, punitive damages may be assessed in amounts up to three times the actual costs of a cleanup. Act 108 grants to the DER specific enforcement powers, although primary authority for responding to water resource contamination rests with the Commonwealth. (Geiger-PTT)
W91-06913

ECOSYSTEM HEALTH, A HUMAN PERCEPTION: DEFINITION, DETECTION, AND THE DICHOTOMOUS KEY.
Ontario Ministry of Natural Resources, Thunder Bay. Fisheries Research Section.
R. A. Ryder.
Journal of Great Lakes Research JGLRDE, Vol. 16, No. 4, p 619-624, 1990. 19 ref.

Descriptors: *Bioindicators, *Environmental monitoring, *Great Lakes, *Lake restoration, *Water pollution effects, Aquatic environment, Data interpretation, Environmental policy, Environmental protection, Lakes, Political aspects, Reviews, Sampling, Social aspects, Water quality monitoring.

The early detection of an encroaching state of malaise in an ecosystem is more difficult than commonly imagined. In attempting to regulate ecosystems to comply with human values, man usually regards timeliness of management applications more highly than precision of future evaluations. One approach for using surrogate organisms as early indicators of ecosystem malaise is the dichotomous key. While the key is not an environmental panacea to ecosystem dysfunction, its proper application will lead to an ecosystem awareness by managers and compel them to consider specific aspects of the environment of biota they might otherwise have overlooked. The fundamental roadblocks to a successful rehabilitation program in the Great Lakes would seem to be (1) lack of coordination in achieving a consensus on ecosystem objectives; (2) inappropriate institutional arrangements for the implementation of various detection or sampling processes such as the dichotomous key; and (3) a lack of political will directed toward proactive rehabilitation programs. Although none of these bottlenecks is intractable, the accumulated inertia generated by them makes a timely and effective solution to the ills of the Great Lakes basin ecosystem unlikely. (See W91-06919 thru W91-06924 and W91-06926 thru W91-06931) (Doria-PTT)
W91-06925

STUDIES ON SALINE SOILS IN KHON KAEN REGION, NORTHEAST THAILAND: III. EFFECTS OF AMELIORATION TREATMENTS ON PHYSICAL AND CHEMICAL PROPERTIES OF THE SALINE SOIL.
Khon Kaen Univ. (Thailand). Faculty of Agriculture.
For primary bibliographic entry see Field 2K.
W91-06977

NATIONAL RESPONSE TEAM: A REPORT ON THE NATIONAL OIL AND HAZARDOUS SUBSTANCES RESPONSE SYSTEM.
National Response Team, Washington, DC.
Annual Report, March 1989. 66p, 7 fig, 4 append.

Descriptors: *Cleanup, *Hazardous wastes, *Management planning, *National Response Team, *Oil spills, Contingency planning, Environmental protection, Federal jurisdiction, Institutions, Interagency cooperation, State jurisdiction.

Every day in the United States, oil and hazardous substances are spilled or released into harbors and waterways, onto the ground and into the air. Some of these incidents cause extreme damage and are so serious that local authorities must call for additional help. State police and environmental agencies can provide expertise and management over a wider area. If additional help is still needed, or if several States are involved--such as when a spill affects a river flowing through several States--a single call to the National Response Center will activate the National Response System. The National Contingency Plan was developed to insure that the resources and expertise of the Federal government would be immediately available for those relatively rare but very serious oil and hazardous substances incidents that require a national or regional response. The NCP established a hierarchy of mechanisms that together form the National Response System: (1) The National Response Team (NRT), a body of 14 Federal agency representatives with expertise related to handling incidents, coordinates the system; (2) The Regional Response Team (RRT) work with State governments to provide guidance and assistance within their regions; (3) The On Scene Coordinator (OSC) manages these Federal responses; and (4) The National Response Center (NRC) acts as the national communications center, receiving reports of incidents and notifying the OSCs. This report provides a review of each of these mechanisms, their roles and responsibilities, and their recent activities. The report is structured to follow the involvement of the Federal Government in an oil or hazardous substance incident, from the first notification to the Federal response and the planning that makes that response possible. Appendix A reports on activities and plans for each of the 13 Regional Response Teams. Appendix B includes a brief description of the key responsibilities and expertise of each of 14 current NRT member agencies. Appendix C is the NRT Workplans for fiscal year 1988 and 1989. Appendix D is a brief history of the National Response System. (Lantz-PTT)
W91-07036

SURFACE-WATER QUALITY IN THE WEST BRANCH SUSQUEHANNA RIVER BASIN, PENNSYLVANIA: AN APPRAISAL OF AREAL AND TEMPORAL VARIABILITY FROM 1962 TO 1982 IN HYDROLOGIC ACCOUNTING UNIT 020502.
Geological Survey, Harrisburg, PA. Water Resources Div.
R. A. Hainly, J. F. Truhlar, and K. L. Wetzel.
Available from Books and Open Files Reports Section, USGS Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4283, 1989. 50 p, 19 fig, 7 tab, 23 ref.

Descriptors: *Data interpretation, *Monitoring, *Surface water, *Susquehanna River, *Water quality, Alkalinity, Aluminum, Ammonia, Hydrogen ion concentration, Manganese, National Stream Quality Accounting Network, Nitrites, Pennsylvania, Sulfates, Water analysis, Zinc.

The West Branch Susquehanna River basin has a drainage area of 6,955 sq mi in north-central Pennsylvania and comprises Hydrologic Accounting Unit 020502. A National Stream Quality Accounting Network (NASQAN) water quality data collection site, maintained by the US Geological Survey (USGS), is located on the river near its mouth at Lewisburg, Pennsylvania. Data collected from the NASQAN site and the sites operated by the PA Department of Environmental Resources from 1962-1982 were used to evaluate water quality variability in the basin. The following objectives were addressed: (1) describe the surface water quality upstream of the NASQAN site on an areal and temporal basis; (2) relate the water quality variability on both an areal and temporal basis, to general basin characteristics; and (3) assess the ability of the water quality data collected at the NASQAN site to represent, on both an areal and temporal basis the water quality for Hydrologic Accounting Unit 020502 upstream from the site. Generally the river was found to have moderately good water quality in the upper reaches, poor water quality in its middle reach, and good water quality near the mouth. Two tributaries, Moshannon Creek (median pH 3.9) and Bald Eagle Creek (median pH 7.8), had the most pronounced effect on the water quality of the river. Of the constituents analyzed, those which exhibited increasing or decreasing trends most frequently were pH, alkalinity, dissolved sulfate, total ammonia, and total nitrite plus nitrate. The largest trends were in the concentrations of total-recoverable aluminum, manganese, and zinc. Causes of areal variation were attributed to land use and geologic variations throughout the basin. Trends which indicate an improvement in water quality are believed to be caused by improvements in the treatment of acid mine drainage and wastewater. Trends which indicated degradation of water quality were generally found in areas where these types of treatment are not yet effective. The NASQAN site at Lewisburg was shown not to represent the water quality of the entire basin, either areally or temporally. It does, however, represent the water quality of the West Branch Susquehanna River at its mouth. (Author's abstract)
W91-07043

SUPERFUND RECORD OF DECISION: UNITED SCRAP LEAD, OH.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
Available from the National Technical Information Service, Springfield, VA 22161, as PB89-206163. Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA/ROD/R05-88/085, September 1988. 71p, 6 fig, 9 tab, append.

Descriptors: *Batteries, *Cleanup operations, *Lead, *United Scrap Lead Site, *Water pollution sources, Arsenic, Cadmium, Excavation, Hazardous wastes, Heavy metals, Industrial wastes, Ohio, Path of pollutants, Revegetation, Soil contamination, Waste disposal.

The United Scrap Lead (USL) site is located in a sparsely populated area approximately one mile south of the City of Troy, Concord Township, Miami County, Ohio. The entire site lies within the 100 year old floodplain of the great Miami River. From 1946-1980, the site was used by a lead reclamation business, reclaiming lead from used automobile batteries and selling it to lead smelters. The lead reclamation operation involved the separation of the batteries from their casings and tops, collection of the lead plates for reprocessing, and the disposal of the tops and casings on-site. The acid was originally discharged directly to an acid seepage field, but beginning in late 1972, the acid was neutralized with ammonia prior to discharge. In 1972 the Ohio Department of Health required USL to implement a wastewater treatment program to fully neutralize the acid. Subsequent testing of the wastewater indicated high levels of lead, cadmium, and other toxic materials. Selected remedial action for this site includes: excavation and on-site treatment of soil and battery casings by washing, with lead recovery and off-site disposal or recycling of casing residues and replacement of cleaned residual soil on-site; excavation and dewatering of tributary sediments followed by on-site disposal with treated soil; construction of a soil cover over disposed material and revegetation; decontamination of buildings and debris followed by off-site disposal; installation of a new residential well; imposition of minimal deed restrictions; and groundwater and surface water monitoring. (Lantz-PTT)
W91-07051

SUPERFUND RECORD OF DECISION: RINGWOOD MINES/LANDFILL, VA.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
Available from the National Technical Information Service, Springfield, VA 22161, as PB89-206312. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/ROD/R02-88/075, September 1988. 45p, 4 fig, 6 tab.

Descriptors: *Cleanup operations, *Groundwater pollution, *Mine wastes, *New Jersey, *Ringwood Mines/Landfill Site, *Water pollution sources, Arsenic, Backfill, Excavation, Hydrocarbons, Landfills, Lead, Monitoring, Revegetation, Soil contamination, Waste disposal.

The Ringwood Mines/Landfill site consists of approximately 500 acres in a historic mining district in Ringwood Borough, Passaic Count;, New Jersey. The site is characterized by abandoned mine shafts and surface pits, an inactive landfill, an industrial refuse disposal area, small surficial dumps, a municipal recycling center and approximately 50 residences. In 1976, the New Jersey Department of Environmental Protection (NJDEP) closed the landfill after determining that leachate emanating from the landfill was contaminating surface water in the area. In July 1982, NJDEP detected moderate levels of VOCs, as well as naturally occurring heavy metals, in groundwater in the northern section of the site. The site was subsequently divided into four discrete areas for investigation. From October 1987 to February 1988 removal action was conducted which entailed excavation and off-site disposal of 7000 cu yd of surficial paint sludge containing lead and total petroleum hydrocarbons in excess of health based levels. Furthermore, there is sporadic and moderate groundwater contamination generally confined to paint sludge locations, exceeding maximum contaminant levels (MCLs) for lead and arsenic. Primary contaminants affecting soil and groundwater are arsenic, lead, and petroleum hydrocarbons. Selected remedial action for this site includes: confirmatory sampling of all soil with excavation and off-site disposal of any soil exceeding health-based levels, followed by backfilling and revegetation; and groundwater, surface water and wetlands monitoring. Since groundwater in the vicinity of paint sludge areas is not used as a drinking water source and natural attenuation is expected to reduce contamination of below health based levels after removal of the source, groundwater will not be treated. (Lantz-PTT)
W91-07054

EFFECT OF IRRIGATED HORTICULTURAL CROPPING ON GROUNDWATER QUALITY: SWAN COASTAL PLAIN, WESTERN AUSTRALIA.
Agricultural Research Service, University Park, PA. Northeast Watershed Research Center.
H. B. Pionke, M. L. Sharma, and J. K. Hosking.
CSIRO Water Resources Series No. 2, 1990. 19p, 7 fig, 5 tab, 19 ref.

Descriptors: *Australia, *Cropping, *Groundwater quality, *Irrigation effects, *Swan Coastal Plain, Agriculture, Groundwater irrigation, Groundwater pollution, Irrigation practices, Irrigation wells, Leaching, Lysimeters, Nitrates, Nitrogen, Nutrients, Phosphates, Phosphorus, Sulfates.

The influence of irrigated horticulture on the nutrient status of groundwater and root zone drainage was examined on the Swan Coastal Plain, Western Australia. This is based on data collected from lysimeter equipped sites, and shallow and deeper irrigation wells positioned to sample these areas. For typically managed market gardens, the potential of nitrogen and phosphorous losses to groundwater is very high. Nutrient applications, mostly as poultry manure, exceeded crop uptake by about five times for nitrogen and by at least 10 times for phosphorous. Leaching of nitrogen and phosphorous to drainage lysimeters or groundwater were practically all nitrate and orthophosphate. The NO3-N concentrations observed in the root zone drainage (71-209 mg/L) and shallow groundwater (9-80 mg/L) underlying market gardens were very high, but considerably less than potentially expected. The deeper wells had a much wider range (0.1-56 mg/L) of NO3-N concentration; of these, one-third of the observations being in the 9-56 mg/L

range. There was evidence of localized denitrification in some of these deeper wells. The orthophosphate-P concentration in the root zone drainage was highly variable and averaged about 0.1 mg/L at one site and about 13.5 mg/L at another site. However, in the deeper wells orthophosphate-P concentrations were low, averaging 0.03 mg/L. These P concentrations were neither related to nitrate or sulfate concentration of groundwaters, nor with the type of land use. Overall, the shallow well network provided a more constituent measure of the effect of market gardens on water quality, whereas the deeper wells were much more influenced through dilution and denitrification. The SO4-S/Cl ratio was generally found to have a much stronger relationship with SO4-S concentrations than with SO4-S/Cl. (Author's abstract)
W91-07055

SUPERFUND RECORD OF DECISION: UPJOHN MANUFACTURING COMPANY, PR.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
Available from the National Technical Information Service, Springfield, VA 22161, as PB89-207262. Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA/ROD/R02-88/071, September 1988. 79p, 17 fig, 4 tab, append.

Descriptors: *Acetonitrile, *Carbon tetrachloride, *Cleanup operations, *Groundwater pollution, *Path of pollutants, *Puerto Rico, *Superfund, Air stripping, Drinking water, Groundwater quality, Hazardous wastes, Organic compounds, Pumping, Soil contamination, Vacuum extraction, Water pollution sources, Wells.

The Upjohn Manufacturing Company (UMC) site is located in Barceloneta industrial park on the north coast of Puerto Rico. The site lies in a limestone region characterized by karst terrain developed by dissolution of the existing limestone formations, and typified by closed depressions, sinkholes, and subsurface conduits. Between August and September 1982, UMC dispatched approximately 15,300 gallons of a manufacturing by-product waste mixture, estimated to be composed of 65% carbon tetrachloride and 35% acetonitrile, to a leaking underground storage tank (UST), resulting in the release of all of the waste into the ground. Investigation by UMC determined that carbon tetrachloride contamination had migrated off-site approximately 2 miles to the north, and occupied an area of about 2.1 cu mi. Consequently, five local water supply wells were closed in 1982 due to carbon tetrachloride contamination, and UMC provided a permanent alternative water supply to users. In 1983, UMC began implementing remedial actions to remove carbon tetrachloride from the soil and groundwater. This included: the installation and operation of a vacuum extraction system until March 1988; groundwater pumpage from AH Robbins well adjacent to and north of the site until 1985; installation and operation of a second groundwater contaminant recovery extraction well, UE-1, on the UMC facility in 1984 with air stripping and residual discharge to a sinkhole; and placement of a concrete cap over the tank farm. In 1987, because of residual groundwater contamination that has remained both on-site and off-site, EPA ordered UMC to continue remedial activities. (Lantz-PTT)
W91-07056

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

RIVER CATCHMENT PLANNING FOR LAND DRAINAGE, FLOOD DEFENCE AND THE ENVIRONMENT.
National Rivers Authority, Thames Region, England.
For primary bibliographic entry see Field 4A.
W91-05971

MULTICRITERION FOREST WATERSHED RESOURCES MANAGEMENT.
Arizona Univ., Tucson. School of Renewable Natural Resources.
A. Tecle, M. Fogel, and L. Duckstein.
IN: Forest Hydrology and Watershed Management. IAHS Publication No. 167. International Association of Hydrological Sciences, Washington, DC. 1987. p 617-625, 3 fig, 20 ref.

Descriptors: *Decision making, *Forest hydrology, *Forest watersheds, *Management planning, *Water resources management, *Watershed management, Alternative planning, Arizona, Forest management, Hydrologic models, Model studies, Sensitivity analysis.

Multicriterion decision making (MCDM) techniques are applicable to forest watershed resources management. An Arizona case study consisting of six alternative schemes was evaluated with respect to 15 noncommensurable, discrete criteria, using two types of MCDM techniques, namely the outranking types of ELECTRE I and II, and the distance-based type of compromise programming (CP). It was concluded that all three techniques can be used to determine the preference ranking of a finite and discrete set of management schemes. The ELECTRE II and CP techniques can provide a complete preference ordering of the nondominated alternatives while ELECTRE I can only indicate a most preferred set of alternatives. All three MCDM techniques determined that the forest watershed resources management scheme with 65% basal area cut was the most preferred alternative. Previous studies indicate that this management plan would produce a resources mix that includes 22 mm of runoff, 85 kg/ha of forage yield, good wildlife habitat, and above-average scenic beauty at a treatment cost of $54/ha and 0.0126 kg/ha sediment loss. To determine the ranking process, each technique requires a number of parameters, the value of which are mostly determined by the decision maker, and which are generally model-specific. Sensitivity analyses on ELECTRE II and compromise programming showed that both are fairly robust with respect to weights. The same is true with respect to concordance indices in the ELECTRE II methodology. ELECTRE I was found to be highly sensitive to changes in the threshold values. With regard to consistency and complete ordering capacity, compromise programming seems to be a preferred technique followed by ELECTRE II. ELECTRE I was simpler to use than ELECTRE II. (See also W91-06510) (Fish-PTT)
W91-06569

PROJECT MANAGEMENT.
Miller Drilling Co., Lawrenceburg, TN.
M. Miller.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 94-96, Winter 1991. 1 fig.

Descriptors: *Environmental engineering, *Management planning, *Project planning, Computers, Critical pathways.

The major objectives of the environmental contractor must be safety, uncompromising construction methodology, and timely completions. The project management approach consists of four phases: project definition, project planning, project implementation and project completion. The definition phase consists of a simple statement of specific objectives that factors in the parameters of time duration, performance, and calculated project costs. During the planning phase, all factors are broken down into sections known as tasks. A task is a definable segment of a project that has a beginning and end, uses resources, and has some cost. The completion of each task is a milestone and tasks that run back to back to complete the project form the critical path. Implementation is the test of the previous phases. A flexible and creative project manager is required to guide the project team by adapting tasks as the project evolves, making modifications necessary to streamline the project and maintain task completions and project objectives. Problems that arise during the completion phase include the 90 percent syndrome when the team is ready to move to the next project, no one knows what to do, and morale is low. This occurs when objectives are not made clear and adjustments are not made or controlled. These problems can be corrected by clear definition and documentation of the problems and solutions and by the correct use of project management. This approach can be effectively used to perform environmental management projects. (Doyle-PTT)
W91-06848

NATIONAL RESPONSE TEAM: A REPORT ON THE NATIONAL OIL AND HAZARDOUS SUBSTANCES RESPONSE SYSTEM.
National Response Team, Washington, DC.
For primary bibliographic entry see Field 5G.
W91-07036

6B. Evaluation Process

EXCEPTIONAL WATERS APPROACH--A FOCUS FOR COORDINATED NATURAL RESOURCES MANAGEMENT.
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
S. M. Born, W. C. Sonzogni, J. Mayers, and J. A. Morton.
North American Journal of Fisheries Management NAJMDP, Vol. 10, No. 3, p 279-289, Summer 1990. 2 fig, 4 tab, 25 ref.

Descriptors: *Fisheries, *Resources management, *Water resources management, Exceptional waters, Fish management, Salmon, Stream fisheries, Surveys, Trout.

The first assessment of state management programs for exceptional trout streams was conducted. The focus was on 'exceptional waters,' (EW) those especially valuable riverine systems that support excellent trout or salmon fishing and are sometimes designated as 'blue ribbon' or 'gold medal' waters. The conclusions were based an a detailed survey of fishery management agencies, as well as reviews of documents and personal interviews. Of states with cold water fisheries, 13 currently have formal EW programs; several others have well-established elements of an EW program. States with EW programs have: (1) a formal system for classifying their exceptional waters; (2) an official process for designation; and (3) coordinated natural resources management arrangements stemming from the designation. The most important factors in identifying exceptional waters are presence of wild trout, high carrying capacity, trophy-size fish, and public access. Exceptional waters programs demand that traditional fishery management activities be coordinated with related natural resources management programs. This is most often accomplished through informal communication, joint planning, and review activities. Given increasing recreational-use pressures, EW programs, which stress integrated resources management, will be an important future trend in the management of sport fisheries. (Author's abstract)
W91-06027

RHINELAND ON THE WAY TO ITS THOUSANDTH ANNIVERSARY OR WATER-ADMINISTRATION IN THE NEXT 100-200 YEARS.
Hoogheemraadschap van Rijnland, Leiden (Netherlands).
For primary bibliographic entry see Field 6E.
W91-06044

QUALITY-ASSURANCE PROCEDURE FOR USE AT TREATMENT PLANTS TO PREDICT THE LONG-TERM SUITABILITY OF CEMENT-BASED SOLIDIFIED HAZARDOUS WASTES DEPOSITED IN LANDFILL SITES.
UKAEA Atomic Energy Research Establishment, Harwell (England).
For primary bibliographic entry see Field 5E.
W91-06134

EXTRACTION PROCEDURE TOXICITY AND TOXICITY CHARACTERISTIC LEACHING

PROCEDURE EXTRACTIONS OF INDUSTRIAL AND SOLIDIFIED HAZARDOUS WASTE.
CH2M Hill, Boston, MA.
For primary bibliographic entry see Field 5E.
W91-06137

STRATEGY FOR MANAGEMENT OF MIXED WASTES AT THE WEST VALLEY DEMONSTRATION PROJECT.
Department of Energy, West Valley, NY. West Valley Demonstration Project.
For primary bibliographic entry see Field 5E.
W91-06150

WASTE REDUCTION AUDITS: MATCHING TYPES TO STAGES.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 5E.
W91-06162

EFFICIENCIES IN WASTE PROCESSING.
University of South Florida, Tampa. Dept. of Civil Engineering and Mechanics.
For primary bibliographic entry see Field 5D.
W91-06171

GROWTH MANAGEMENT: A RENEWED AGENDA FOR STATES.
National Conference of State Legislatures, Denver, CO.
G. Meeks.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 600-604, November/December 1990. 1 fig, 1 tab, 8 ref.

Descriptors: *Land development, *Open space, *Regional development, *Resources management, Conservation, Economic development, Forest management, Groundwater management, State jurisdiction, Wetland mitigation, Wetlands.

Natural resource managers have long been active in formulating and administering government policies for environmental conservation. Typically, states regulate activities through such authorities as forest practice, wetlands preservation, and groundwater management acts. Local governments traditionally have used their police powers, such as zoning, to regulate land use. A new approach being formulated by some states and regional authorities may involve a much more extensive and comprehensive means of managing resources. Growth management and comprehensive planning acts are being enacted that may change not only the nature of land use but also the decision-making processes that affect our social and economic geography. Nine states (Florida, Georgia, Hawaii, Maine, New Jersey, Rhode Island, Oregon, Vermont, and Washington) have been identified as having statewide growth management or comprehensive planning programs. Another seven states (California, Maryland, New York, Pennsylvania, Virginia, Washington, and West Virginia) have gubernatorial growth strategies commissions or have held conferences focusing on land use issues with the objective of developing growth management legislation. Goals include economic development, farm and forest (open space) land preservation, natural resource conservation, affordable housing, coordinated infrastructure and transportation development, air and water quality, historic and special areas preservation, natural hazards mitigation, recreation resource enhancement, and energy conservation. Autonomy of local land use authority has been the crucial issue in most debates over state growth management programs. The negotiation process becomes critical to success or failure of the programs. The tone of many officials involved in developing these new planning programs may sound like political frustration in trying to cope with conflicting demands. But to hear state officials refer to carrying capacity is a dramatic change from previous years, when the land use debate was on an ideological level that failed to recognize economic problems imposed by lack of planning. (Mertz-PTT)
W91-06227

ENERGY, WATER, AND ECONOMIC SAVINGS OF IMPROVED PRODUCTION SYSTEMS ON THE TEXAS HIGH PLAINS.
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W91-06402

ECONOMIC VALUE OF WETLANDS-BASED RECREATION.
Georgia Univ., Athens. Dept. of Agricultural Economics.
J. C. Bergstrom, J. R. Stroll, J. P. Titre, and V. L. Wright.
Ecological Economics, Vol. 2, p 129-147, 1990. 3 fig, 4 tab, 32 ref, append.

Descriptors: *Economic evaluation, *Estuaries, *Recreation, *Water resources management, *Wetlands, Benefits, Brackish water, Coastal zone management, Freshwater, Recreation demand, Surveys.

Wetland studies have focused primarily on quantifying the commercial, storm protection, and energy output values of these areas. Relatively little research has been devoted to quantifying the outdoor recreational value of wetlands. Within a total economic value framework, the recreational value of wetlands consists of many value components which are broadly divided into non-use, current use, and future use values. Each of these catagories can be further subdivided into expenditures and consumer's surplus. To measure expenditures and consumer's surplus associated with on-site current recreational uses of coastal wetlands areas, a study area containing approximately 1.32 million ha of diverse ecosystems composed of fresh water marsh, brackish marsh, open water and dry land, was surveyed by conducting personal on-site interviews with recreational users at 88 boat launch sites. They were also asked to participate in a mail questionnaire survey to report typical expenditures per person on a trip to the study area. Expenditure catagories included transportation, boat rental, fees, lodging, food and beverages, bait and ammunition. Fixed expenses such as cost of a boat were not considered. Aggregate expenses were estimated to be $118 million and aggregate consumer's surplus was estimated to be $27 million. These results suggest that the economic impacts and net benefits associated with wetlands-based recreation may be substantial. (Doyle-PTT)
W91-06831

MANAGING RESOURCES OF THE MURRAY-DARLING BASIN OF AUSTRALIA.
D. J. Alexander.
Water Resources Journal, No. 164, p 87-99, March 1990.

Descriptors: *Australia, *Murray-Darling River Basin, *River management, *Saline water intrusion, *Water resources management, *Watershed management, Administrative agencies, Environmental effects, Land use, Management planning, River basins, Water pollution effects.

The resources of the Murray Darling basin are vital to the economics and cultural development of Australia. The competition for the use of these resources has reached a point where their sustainability is under question. The major physical problems relate to the critical dependency of over one million people on the quality and quantity of domestic water supply; vegetation decline and land degradation; rising groundwater levels in saline (post-marine) sediments; and the loss of flora and fauna assets. In addition much needs to be done to conserve the cultural heritage, both Aboriginal and European, of the basin. The Murray Darling Basin Ministerial Council (MDBMC) represents an alliance of four governments, and consists of up to 12 minister whose job it is to promote and coordinate effective planning and management for the equitable, efficient and sustainable use of the land, water and environmental resources of the Murray Darling basin. Salinity in the basin has increased particularly downstream of the South Australia border due to natural drainage of highly saline groundwater and anthropogenic clearing of vegetation which has caused greater recharge and rising groundwater levels. Overgrazing and the effects of farming have degraded water quality downstream in the form of increased salinity, bacteria, turbidity, and nutrient input. To obtain community-based advice on the management of the Murray Darling basin the MDBMC formed the Community Advisory Committee. The Salinity and Drainage Strategy of the MDBMC is based on a balance between improved land management, which addresses the fundamental causes of salinity; salt interception schemes, which reduce salinity at the point of entry to major rivers; and optimal river management, which reduces instream salinity by dilution and flushing. The MDBMC and the Commission has prepared the natural Resources Management Strategy to address the more diverse problems of the basin's environment. The strategy establishes the concept of Communities of Common Concern to fund local groups that are dealing with problems of resource degradation. (Geiger-PTT)
W91-06902

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

STUDY OF THE PLANNING OF WATER POLLUTION CONTROL FOR SECOND SONGHUA RIVER IN CHINA.
Jilin Architectural and Civil Engineering Inst., Changchun (China). Dept. of Urban Engineering.
For primary bibliographic entry see Field 5G.
W91-06043

COSTS FOR REDUCING FARMERS' USE OF NITROGEN IN GOTLAND, SWEDEN.
Sveriges Lantbruksuniversitet, Uppsala. Inst. of Economics.
For primary bibliographic entry see Field 5G.
W91-06107

EFFECTIVE COST-SHARE RATES AND THE DISTRIBUTION OF SOCIAL COSTS IN THE ROCK CREEK, IDAHO, RURAL CLEAN WATER PROJECT.
Idaho Univ., Moscow. Dept. of Agricultural Economics.
D. J. Walker, D. T. Noble, and R. S. Magleby.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 4, p 477-479, July/August 1990. 2 fig, 7 ref.

Descriptors: *Cost sharing, *Economic aspects, *Idaho, *Nonpoint pollution sources, *Rock Creek, *Rural areas, *Water policy, *Water pollution control, *Water quality management, Agricultural practices, Agricultural runoff, Costs, Crop yield, Government supports, Irrigation practices, Linear programming, Loans, Public policy, Social aspects, Taxes, Water Quality Act, Water conservation, Watershed management.

The effective federal cost-share rate for conservation practices often differs markedly from the nominal rate. The effective cost-share rate affects practice adoption, economic efficiency of the subsidy, and the distribution of water quality costs between public and private sectors. Using a linear programming model, the effective federal cost-share rate and thus the distribution of water quality improvement costs for the Rock Creek Rural Clean Water Program watershed in Idaho was estimated. The federal government paid 62% of farmer cost through subsidies. The public share of total project costs is 84%, and the private share is only 16%. This effective federal cost-share rate of 84% compares to a nominal rate of 56%. The effective federal cost-share rate is likely higher than that required for economic efficiency. Government subsidies are instrumental under voluntary programs for encouraging farmer adoption of water quality practices. (Author's abstract)
W91-06116

MINIMIZING WASTE BY CHARGING THE GENERATOR.

Oak Ridge National Lab., TN. Chemical Technology Div.
For primary bibliographic entry see Field 5E.
W91-06161

6D. Water Demand

PERSPECTIVE OF WATER RESOURCES IN JAPAN AND IN THE WORLD.
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
T. Ishibashi.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 11-18, 1991. 1 fig, 5 tab, 3 ref.

Descriptors: *Japan, *Water conservation, *Water resources, *Water shortage, Recycling, Water costs, Water reuse, Water supply development.

Problems of water shortages are becoming global in both developed and developing countries, due to increases in population, urbanization, and industrialization. Although blessed with heavy rainfall, Japan is expected to experience water shortages in the early part of next century, particularly in the belt linking Tokyo with the large industrial cities to the west. This is due to the large population of this region, high level of urbanization and industrialization, poor topographic setting for developing new resources or importing water, and rapid sedimentation rates in existing reservoirs. Possible increases to the water supply may be obtained by additional dams on rivers and at river mouths, basin-to-basin water transfers, improving irrigation techniques, and development of additional groundwater resources. Many conservation techniques are currently in use in Japan, including recycling of industrial water, recycling by large users such as office buildings and housing complexes, treatment and reuse of wastewater, and the use of rainwater as general service water. Additional water savings can be realized during severe shortages by reducing water pressure to end-users, restricting water availability to a specific time of day, using water-saving appliances, reusing laundry water and recycling bath water for laundry uses, and restricting the use of water for lawns and washing cars. The maximum rate of water saving through voluntary measures by consumers appears to be about 20-25%. Higher saving rates have been achieved in the past through a variety of economic incentives and penalties for excess use. Savings of 50% are possible using stronger enforcement techniques. (Tappert-PTT)
W91-06040

EVOLVING ISSUES ON DEVELOPMENT AND CONSERVATION OF LAKE BIWA--YODO RIVER BASIN.
Kyoto Univ., Otsu (Japan). Otsu Hydrobiological Station.
M. Nakamura, and M. Akiyama.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 93-103, 1991. 1 fig, 1 tab, 7 ref.

Descriptors: *Japan, *Water demand, *Water quality management, *Water resources development, *Water supply development, Lake management, Lake stages, Water level, Water management.

Lake Biwa is situated in the uppermost reach of the Yodo River Basin and occupies one-sixth of the prefectural territory of Shiga. In the downstream reach of the basin are such metropolitan areas such as Kyoto and Osaka, and the issues involving development and conservation of Lake Biwa have been extremely important for Shiga, Kyoto, Osaka, and other suburban communities within the basin as well as neighboring areas such as Hyogo Prefecture. Throughout history, there were a number of upstream-downstream conflicts of interest. The Lake Biwa Comprehensive Development Plan, a plan involving development of a new water resource amounting to 40 cubic meters per second for Osaka and Hyogo, together with compensatory public work projects for Shiga, has been worked in for almost 20 years and is about to be completed. The social and economic situations have changed over this period, and the actual demand for water has proved to be less than the original prediction that was used as the basis for the plan. There had been claims against the Plan that the large scale development plan involving lowering of the lake level by as much as 1.5 to 2.0 meters might cause irreversible damage to the lake. (Author's abstract)
W91-06049

WATER DEMAND MANAGEMENT: AN EVALUATION OF A 'SOFT' SOLUTION FOR THE HAMILTON HARBOUR REMEDIAL ACTION PLAN.
Inland Waters Directorate, Burlington (Ontario). Water Planning and Management Branch.
For primary bibliographic entry see Field 5G.
W91-06050

DETERMINANTS OF DOMESTIC WATER USE IN RURAL NICARAGUA.
Liverpool School of Tropical Medicine (England). Dept. of International Community Health.
P. Sandiford, A. C. Gorter, J. G. Orozco, and J. P. Pauw.
Journal of Tropical Medicine and Hygiene JTMHA9, Vol. 93, No. 6, p 383-389, December 1990. 1 fig, 3 tab, 16 ref.

Descriptors: *Developing countries, *Domestic water, *Nicaragua, *Public health, *Rural areas, *Water use, Cattle, Education, Regression analysis, Social aspects, Water supply.

In order to investigate the factors affecting domestic water use in rural areas of developing countries, an analysis was performed of water consumption estimates from 1,029 different households in Nicaragua collected between May 1986 and December 1988. Eight of the 22 variables hypothesized to be related to per capita domestic water consumption were included in the final multiple regression model. These were: household size, site of clothes washing, type of water source, mother's and father's level of schooling, distance to the water source, wealth, and ownership of cattle. According to the model, a decrease in the distance to the water source from 1,000 to 10 m is associated with an increase in per capita water consumption of 20%. Similarly, families where the mother has 6 years of schooling use 17% more water than families where the mother has had no formal education. The same difference in the father's schooling is associated with 12% greater per capita consumption. A better understanding of the factors influencing domestic water use is needed to improve the design of interventions aimed at reducing the transmission of water-borne disease in developing countries. (Author's abstract)
W91-06119

MODELLING AGRICULTURE TO SUPPORT REGIONAL WATER MANAGEMENT.
Winand Staring Centre for Integrated Land, Soil and Water Research, Wageningen (Netherlands).
J. Vreke.
European Review of Agricultural Economics, Vol. 17, No. 3, p 317-334, 1990. 3 fig, 3 tab, 4 ref.

Descriptors: *Agricultural practices, *Hydrological models, *Model studies, *Regional planning, *The Netherlands, *Water resources management, Decision making, Farm management, Future planning, Groundwater quality, Regional development, Water requirements.

Users of groundwater and surface water in a region often have conflicting requirements concerning availability and quality of the water. In order to support regional water management a decision support system was formulated. Modeling agriculture within this system involves a qualitative description of processes at farm level, while also taking into account hydrological conditions. The model consists of two blocks; the production block concerned with the production process and the interaction with the water system, and a development block concerned with changes in size and nature of activities and equipment. An aggregated and simplified version of this model (OPTAG) is used to identify, by optimization, possible future states of the region. The usability of the optimization is demonstrated by results from the Southern Peel, a sandy region with a total area of about 30,000 ha in the south Netherlands. Relevant users in this region are agriculture, environment, and public water supply. The model was used for three scenarios: the current state (1982); target state 1 (in which peat areas are conserved and groundwater quality is guaranteed); and target state 2 (in which the set of constraints were revised to allow for increase in technologies). Based on the model results, it appears that, if the environment is to be protected and if groundwater extraction is to be guaranteed then either factory farming must be reduced or manure processing (including export of manure) further developed. (VerNooy-PTT)
W91-06791

6E. Water Law and Institutions

RIVER BASIN WATER QUALITY MANAGEMENT IN JAPAN - AN OVERVIEW.
Ministry of Construction, Tokyo (Japan). Dept. of Sewerage and Sewage Purification.
For primary bibliographic entry see Field 5G.
W91-06042

RHINELAND ON THE WAY TO ITS THOUSANDTH ANNIVERSARY OR WATER-ADMINISTRATION IN THE NEXT 100-200 YEARS.
Hoogheemraadschap van Rijnland, Leiden (Netherlands).
E. H. baron van Tuyll van Serooskerken.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 49-55, 1991. 7 ref.

Descriptors: *Climatic changes, *Sea level, *The Netherlands, *Water districts, *Water management, *Water resources management, Brackish water, Land reclamation, Rhineland, Sea walls.

The effects of sea level rise and expected climatic change over the next 100-200 years on the level of the district water authorities in the Netherlands has been evaluated. Particular emphasis is attached to the impact on the 'hoogheemraadschap' of Rhineland, the oldest water authority in Holland, and responsible for water administration in the central part of Holland since the Middle Ages. Although only representing 5% of the total land area of the Netherlands, the Rhineland and its two neighboring water districts serve 17.5% of the population, including all of the major cities. Special attention is paid to the effects on land utilization, coastal defense and water control. Although Holland is a country generally below sea level and with large areas of 'made' land, surprisingly little research has been conducted concerning land utilization, and additional research is needed. Preliminary conclusions are that larger efforts on coastal defense, even with present techniques, will be realistic in terms of cost assuming a rise on the order of 0.6 m/century. A predicted 5-10% increase in brackishness, both in areal extent and salinity, will create a significant extra need for fresh water. High cost and even higher risks have to be expected with regard to measures to neutralize the effects of a water surplus and attendant flooding in winter and a growing water shortage in late summer. Because of a rise in sea level a larger land area will have to be drained. Research into special effects of cultural changes in Europe as a result of climatic changes is urgently needed, as well as further investigation of the water supply potential of the main rivers. (Tappert-PTT)
W91-06044

RIVER BASIN MANAGEMENT IN THE UK.
Middlesex Polytechnic, Enfield (England).
M. A. House.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 57-64, 1991. 1 fig, 11 ref.

Descriptors: *England, *Legislation, *River basin development, *River regulations, *Water law, *Water policy, *Water pollution control, Catchments, Regulations, Water rates.

The Water Act of 1989 has resulted in the reorganization of the system of River Basin Management

which has operated in England and Wales since the establishment of the 10 Water Authorities (WAs) in 1974. The WAs were responsible for all water functions within their geographic region with the purpose of minimizing conflicts between competing water users and maximizing economy of scale. The WAs relied upon catchment based water management and promoted the separation of water management from local governments that did not have the resources or perspective for proper administration. Although the river basin approach was by most accounts a success, the WAs were criticized as lumbering and unaccountable monopolies showing a poor return on assets and ineffective in both complying with and enforcing the increasing number of environmental laws being developed during the 1970s. On 1 September 1989 the Water Authorities were restructured to produce 10 Water Service Companies and a new regulatory body, the National Rivers Authority (NRA). The philosophy behind the 1989 Water Act was to develop tightly regulated, licensed companies with responsibilities limited to the provision of water supply and sewerage services, with environmental regulatory concerns the responsibility of the NRA. The operation of the Water Service Companies is regulated by a new agency, the Office of Water Service (OWS), which reports to Parliament. The OWS regulates prices, levels of service, and the financial structure of the OWSs. The NRA regulates discharges and enforces environmental laws pertaining to the WSCs. River basin management is going through an era of great change, the consequences of which will not be seen for years to come. (Tappert-PTT)
W91-06045

BEYOND THE DECADE: A GLOBAL FRAMEWORK FOR GLOBAL COOPERATION.
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
For primary bibliographic entry see Field 5G.
W91-06061

CURRENT SITUATION AND PROBLEMS OF JAPANESE INTERNATIONAL COOPERATION IN THE FIELD OF WATER SUPPLY AND WASTE MANAGEMENT.
Ministry of Health and Welfare, Tokyo (Japan). Water Supply and Environmental Sanitation Dept.
K. Yokoo.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 215-221, 1991. 4 tab, 5 ref.

Descriptors: *Developing countries, *Financing, *International agreements, *Japan, *Wastewater treatment, *Water quality control, *Water supply, *Water treatment, Waste management, Water management.

In order to improve public health in developing countries, the United Nations General Assembly decided to launch the International Drinking Water Supply and Sanitation Decade in 1980. In the first half of the Decade, only one-third of the minimum funds required to achieve the Decade target was invested. Therefore, advanced countries, including Japan, are required to expand international cooperation more widely. Requests to Japan for technical cooperation and financial assistance have been rapidly increasing in the field of water supply and waste management. In Japan, international cooperation, such as Official Developing Assistance (ODA) is expanding rapidly, and a further interim target was set in the meeting of the ministers related to executing ODA in June 1988. In this target Japan will provide more than fifty billion dollars in total during five years from 1988 to 1992. In addition to investment, in order to promote the Decade, it is necessary to solve problems such as the raising of funds for operation/management costs, development of human resources in developing countries, the study of appropriate technology, and the training of experts. (Author's abstract)
W91-06062

CHEMICAL EMISSIONS FROM THE PROCESSING AND USE OF MATERIALS: THE NEED FOR AN INTEGRATED EMISSIONS ACCOUNTING SYSTEM.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5G.
W91-06109

NUCLEAR REGULATORY COMMISSION REGULATIONS AND EXPERIENCE WITH SOLIDIFICATION/STABILIZATION TECHNOLOGY.
Nuclear Regulatory Commission, Washington, DC. Low-Level Waste Licensing Branch.
For primary bibliographic entry see Field 5E.
W91-06132

CHARACTERIZATION AND CONTROL OF SOLIDIFIED RADIOACTIVE WASTES ACCORDING TO THE ITALIAN RULES: ORGANIZATION OF A CHARACTERIZATION FACILITY AND FIRST RESULTS.
ENEA, Rome (Italy). Nuclear Fuel Cycle Div.
For primary bibliographic entry see Field 5E.
W91-06133

GROWTH MANAGEMENT: A RENEWED AGENDA FOR STATES.
National Conference of State Legislatures, Denver, CO.
For primary bibliographic entry see Field 6B.
W91-06227

REDUCING AGRICULTURAL PESTICIDE USE IN SWEDEN.
Environmental Protection Agency, Washington, DC. Nonpoint Sources Branch.
For primary bibliographic entry see Field 5G.
W91-06229

WATER RESOURCE PLANNING IN CANADA.
T. McMillan.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 6, p 614-616, November/December 1990.

Descriptors: *Canada, *Water law, *Water policy, *Water pollution control, *Water resources management, Conservation, Environmental protection, Legal aspects, Sludge treatment, Water costs, Water resources.

Creation of a federal water policy between 1985 and 1988 constituted a new direction for Canada. The objective of the new Canadian federal water policy was to provide a framework from which all water-related decisions of the federal government would be made, not just by the Department of the Environment, but by every other department and agency as well. The policy's two main goals were to protect and enhance the quality of the water resources and to promote the wise and efficient management and use of water. To advance these two goals, the government developed five specific strategies: to introduce more realistic water pricing as a means of reducing demand and generating revenues to cover costs; to improve scientific and technological leadership for managing Canada's water resources; to achieve better policy integration, between the federal government and the provinces and cities as well as between federal agencies; to overhaul federal water laws to make them more anticipatory and comprehensive; and to seek to change fundamentally public attitudes toward the value and importance of water and related resources. The federal government has been launching highly innovative programs to make water management more efficient and less costly. One of its greatest successes has been in technology development. A case in point is a multi-million-dollar federal government-private sector oil-from-municipal sludge project that will revolutionize the way cities dispose of waste. The Canadian government is moving ahead on safe drinking water legislation that will set minimum standards in areas of federal jurisdiction and regulate chemicals used in treating water. The minister of fisheries has developed a fisheries habitat policy that helps integrate activities governed by the Canadian Fisheries Act with activities in the same area regulated by the provinces. (Mertz-PTT)
W91-06230

SWAMPBUSTER IMPLEMENTATION: MISSED OPPORTUNITIES FOR WETLAND PROTECTION.
Environmental Law Inst., Washington, DC.
J. M. McElfish, and K. J. Adler.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 3, p 383-385, May/June 1990. 2 fig, 1 tab, 6 ref.

Descriptors: *Conservation, *Land use, *Swamps, *Wetlands, Administration, Administrative agencies, Agricultural practices, Drainage, Drainage effects, Federal jurisdiction, Swampbuster program.

The effectiveness of the swampbuster program of the U.S. Department of Agriculture in the protection of wetlands is assessed. Between the inception of the program in late 1985 and January 20, 1990, the Soil Conservation Service documented that 82,586 acres of former wetlands had been drained in violation of swampbuster. In 1989, the EPA determined that wetland conversion had declined in six out of seven counties analyzed by remote sensing techniques. It is concluded that swampbuster appears to have had a positive effect on slowing the rate of wetland conversion to agriculture. Nevertheless, the effectiveness of the program is limited because of weaknesses in implementation, the most significant of which are the commenced exemption, weak enforcement procedures, one-sided appeal procedures, and the definition of a swampbuster violation. It is recommended that the 1990 farm bill should continue the swampbuster program with amendments. (MacKeen-PTT)
W91-06274

LOW-INPUT AGRICULTURE REDUCES NONPOINT-SOURCE POLLUTION.
Environmental Protection Agency, Washington, DC. Nonpoint Sources Branch.
For primary bibliographic entry see Field 5G.
W91-06304

AGRICULTURE'S ROLE IN PROTECTING WATER QUALITY.
Office of Management and Budget, Washington, DC. Natural Resources Div.
For primary bibliographic entry see Field 5G.
W91-06305

PENNSYLVANIA'S SUPERFUND LAW AND GROUNDWATER MANAGEMENT.
Reed, Smith, Shaw and McClay, Harrisburg, PA.
For primary bibliographic entry see Field 5G.
W91-06913

6F. Nonstructural Alternatives

LOW-RESOURCE AGRICULTURE ALTERNATIVES IN SUB-SAHARAN AFRICA.
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W91-06114

6G. Ecologic Impact Of Water Development

WILLIAM A. CANNON: THE SONORAN DESERT'S FIRST RESIDENT ECOLOGIST.
Geological Survey, Tucson, AZ.
J. E. Bowers.
Madrono; A West American Journal of Botany MADRAU, Vol. 37, No. 1, p 6-27, 1990. 1 fig, 45 ref.

Descriptors: *Arizona, *Biographies, *Desert plants, *Ecology, *Research facilities, *Sonoran Desert, Arid lands, Desert ecosystems, Oxygen, Physiological ecology, Roots, Temperature.

William Austin Cannon (1870-1958) was the first resident investigator at the Carnegie Institution of Washington's new Desert Laboratory in Tucson, Arizona. This laboratory was devoted to ecology before the very word was widely used. Cannon pioneered in the physiological ecology of desert plants and in the study of root systems, particularly the effects of oxygen and temperature on root growth. He also held a worldwide interest in desert ecosystems. His comparative studies of arid regions led him to point out convergent evolution (although he did not use this term) in desert plants. Well-known during his lifetime, he has since been largely forgotten. (Medina-PTT)
W91-06008

HISTORICAL AND PRESENT DAY MANAGEMENT OF THE RIVER RHINE.
Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).
For primary bibliographic entry see Field 5G.
W91-06051

ENVIRONMENTAL ASPECTS OF STABILIZATION AND SOLIDIFICATION OF HAZARDOUS AND RADIOACTIVE WASTES.
For primary bibliographic entry see Field 5E.
W91-06124

NTNF--PROGRAMME ON ENVIRONMENTAL IMPACTS ('MVU'): RESEARCH AND REFERENCE CATCHMENTS PROJECT ('FORSK-REF').
Oslo Univ. (Norway). Lab. for Freshwater Ecology and Inland Fisheries.
For primary bibliographic entry see Field 4C.
W91-06507

FOREST HYDROLOGY AND WATERSHED MANAGEMENT.
For primary bibliographic entry see Field 4C.
W91-06510

SEASONAL RESPONSE OF THE LOWER ST LAWRENCE ESTUARY TO BUOYANCY FORCING BY REGULATED RIVER RUNOFF.
Institut National de la Recherche Scientifique, Rimouski (Quebec). Centre d'Oceanologia.
For primary bibliographic entry see Field 2L.
W91-06765

IMPACT OF FRESHWATER RUNOFF ON PHYSICAL OCEANOGRAPHY AND PLANKTON DISTRIBUTION IN A WESTERN NORWEGIAN FJORD: AN EXPERIMENT WITH A CONTROLLED DISCHARGE FROM A HYDROELECTRIC POWER PLANT.
Bergen Univ. (Norway). Dept. of Marine Biology.
For primary bibliographic entry see Field 2L.
W91-06766

PRESENT GROUNDWATER STATUS IN EGYPT AND THE ENVIRONMENTAL IMPACTS.
For primary bibliographic entry see Field 2F.
W91-06798

RAPID FORMATION OF LARGE COASTAL SAND BODIES AFTER EMPLACEMENT OF MAGDALENA RIVER JETTIES, NORTHERN COLOMBIA.
Instituto Nacional de Investigaciones Geologico-Mineras, Bogota (Colombia).
For primary bibliographic entry see Field 2J.
W91-06800

REDIVERSION SALINITY CHANGE IN THE COOPER RIVER, SOUTH CAROLINA: ECOLOGICAL IMPLICATIONS.
South Carolina Univ., Columbia. Marine Science Program.
For primary bibliographic entry see Field 2L.
W91-06834

ENVIRONMENTAL EFFECTS OF THE MAHI-KADANA AND DHAROI PROJECTS AT GUJARAT, INDIA.
Gujarat Water Resources Dept., Gandhinagar (India).
J. F. Mistry, and M. U. Purohit.
Water Resources Journal, No. 164, p 93-97, March 1990. 2 fig, 3 tab, 5 ref.

Descriptors: *Dam effects, *Environmental effects, *India, *Irrigation programs, *Reservoirs, *Weirs, Ecological effects, Flooding, Groundwater recharge, Water supply, Water table fluctuations.

The Mahi-Kadana and the Dharoi multipurpose irrigation projects in Gujarat, India, have had many beneficial and adverse effects since their completion. The Kadana reservoir meets the water supply needs of several urban and rural areas. The agriculture of the area has been greatly improved due to the Mahi-Kadana project, and the Kadana hydro-power station has a capacity of 240 MW. The presence of the reservoir has increased fisheries and become a recreational attraction. The major ecological impacts resulting from the project include the submergence of fertile lands, dislocation of inhabitants, changes in the scenic values, micro-climatic changes and effect on flora and fauna of the neighborhood. The increased flows from the reservoir have affected the river bed cultivation, quarrying of sands and gravel, and transportation of people and products across the river. Water logging and salt efflorescence problems were observed in the lower service areas. Although the remedial measures of improved water management, canal lining and surface drainage have reduced the problem considerably in the upper areas, this has still remained unsolved to a certain extent in the lower reaches. A drainage network was completed to alleviate some of the problems. Malaria control and prevention measures were stepped up after prevalence of this disease increased due to flooding conditions. The Dharoi project offers a reservoir which provides irrigation, water supply, and partial flood control. A study of the groundwater resources in the area showed that 95 cu hm of water are available in the command area for conjunctive use with the surface water. However, in Mehsana district the water tables have been lowered by over 100 m in the last 25 yr due to over-withdrawal of groundwater. Major ecological impact includes submergence of lands, micro-climatic changes, waterlogging and reduction in soil fertility. Submergence of forests is also a problem that is being addressed by encouraging farmers to grow orchards for wood preservation. (Geiger-PTT)
W91-06903

CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE MISSOURI RIVER, NEBRASKA.
Nebraska Game and Parks Commission, Norfolk.
L. W. Hesse, G. E. Mestl, and M. J. Rohrke.
Transactions of the Nebraska Academy of Sciences and Affiliated Societies TNASDJ, Vol. 17, p 103-109, 1989. 1 fig, 7 tab, 16 ref.

Descriptors: *Channeling, *Dam effects, *Missouri River, *Nebraska, *Physicochemical properties, *Turbidity, *Water quality, Chemical properties, Chlorophyll, Flow rates, Nutrients, Organic matter, Physical properties.

Selected physical and chemical parameters were observed at unchannelized and channelized main-channel locations on the Missouri River, an unchannelized backwater, and 13 tributaries of the Missouri River during the period 1985 through 1988. Mean main-channel discharge is artificially maintained at a higher rate during winter since construction of the main-stem dams. The mean flow through a remnant backwater in an unchannelized reach represents about 3.1% of the main-channel discharge. Turbidity is much reduced from the pre-dam period and is highest during the March and June periods of high discharge. Specific conductance in the main channel was measured as high as 955 umhos/cm. Water quality parameters are similar for unchannelized and channelized sites, although organic matter, as measured by total organic carbon and fine and coarse particulate organic matter, is higher proceeding downriver. The water quality of the unchannelized reach backwater basically reflects the water quality of the main channel, except that dissolved oxygen is reduced in some locations within the backwater and total chlorophyll values are double those found in the main channel. Tributary water quality is highly variable and most observed values were higher than main-channel values near these tributaries. Continued observations will help explain the role that tributary run-off plays in main-channel water quality as samples are acquired during run-off events such as flooding. It was hypothesized that the Missouri River may have been one of the most productive ecosystems in temperate North America. Additional research into carbon/nutrient dynamics and the mechanism through which this energy reached the aquatic system is necessary to substantiate this hypothesis. (Author's abstract)
W91-07009

PERSISTENCE OF A CHEMICAL GRADIENT IN THE LOWER PLATTE RIVER, NEBRASKA.
Nebraska Univ.-Lincoln. Dept. of Forestry, Fisheries and Wildlife.
R. S. Holland, and E. J. Peters.
Transactions of the Nebraska Academy of Sciences and Affiliated Societies TNASDJ, Vol. 17, p 111-115, 1989. 5 fig, 1 tab, 9 ref. Federal Aid for Fish Restoration Funds Project F-78-R-1.

Descriptors: *Aquatic habitats, *Canals, *Chemical properties, *Conductance, *Electric powerplants, *Environmental effects, *Environmental gradient, *Nebraska, *Platte River, *Water chemistry, Flow rates, Hydraulic roughness, Mixing, Water quality.

During a 1986-1987 study of microhabitat utilization by Platte River fauna a persistent difference in conductance was noted between north and south banks. A series of transects across the river, measured on August 11, 1987, between River Miles 78-59, demonstrated that the conductivity gradient persisted throughout the 32 km study segment. Typical readings were 315 umhos/cm for the north side and 550 umhos/cm for the south side. Additional upstream measurements showed that the gradient originated at the confluence of the Platte River and the Loup River Power Canal (River Mile 101). Upstream, the Platte River mean monthly conductivity is 922 umhos/cm while the Canal is 283 umhos/cm. Correlation analysis of the relative contribution of the Canal to total downstream discharge shows a significant negative correlation ($r=0.60$; $P=.0001$) to the conductivity levels of the Platte River below the confluence. Occurrence of this conductivity gradient may indicate a lack of mixing of other chemical constituents in the water including pollutants. Factors that determine the persistence of the difference in conductance include sinuosity of the channel, roughness of the bed, relative flow rates of the intersecting rivers, entry angle of the tributary, and the degree of water quality differences between the rivers. (Author's abstract)
W91-07010

REPORT ON ARCHAEOLOGICAL TESTING AT SALISHAN MESA (45GR445), GRANT COUNTY, WASHINGTON.
Eastern Washington Univ., Cheney. Archaeological and Historical Services.
R. A. Masten, R. L. Lyman, C. R. Knowles, and R. C. Boggs.
1988. 116p, 14 fig, 14 tab, 52 ref, 5 append.

Descriptors: *Archaeology, *Social aspects, Banks Lake, Grand Coulee Dam, History, Washington, Water resources development.

In October of 1987, archaeological test excavations were conducted at archaeological site 45GR445, also known as the Salishan Mesa. The purpose of this investigation was to obtain information for cultural resource management planning and to assess the site's potential for eligibility for inclusion on the National Register of Historic Places. Site 45GR445 is located east of and adjacent to the Upper Grand Coulee, now Banks Lake, northeast of Coulee City within Grant County Washington.

The site area is large and includes several landforms associated with topography of the Channeled Scablands of Central Washington. Thirty-eight cultural features, including the rockshelter, a surface depression, and numerous rock features, were investigated. Nine test units were excavated in areas with the potential for subsurface deposits. Over 10,000 lithic artifacts and debris, faunal remains, and other organics were recovered from the site. One radiocarbon date was obtained from the base of the surface depression and has tentatively placed one occupation of 45GR445 at 2330 +/-80 years before present (B.P.). The sample of artifact and feature data indicates that 45GR445 is a base camp primarily associated with the procurement and processing of large game. Based on the quantity, quality, and diversity of artifact and future large-scale investigations. It is, therefore, recommended as eligible for inclusion in the National Register of Historic Places. (Lantz-PTT)
W91-07038

ARCHAEOLOGICAL INVESTIGATIONS AT RIVER MILE 590: THE EXCAVATIONS AT 45DO189.
Eastern Washington Univ., Cheney. Archaeological and Historical Services.
J. R. Galm, R. L. Lyman, D. F. Stradling, E. Gilmour, and R. A. Stevens.
1988. 224p, 41 fig, 55 tab, 152 ref, 6 append.

Descriptors: *Archaeology, *Columbia River, *Social aspects, Grand Coulee Dam, History, Water resources development.

Data recovery excavations were conducted at archaeological site 45DO189 in 1986. This investigation was completed in conjunction with the U.S. Bureau of Reclamation's (USBR) Downstream Stabilization Program to mitigate on-going impacts to the site caused by the operation of the Third Powerplant at Grand Coulee Dam. The site is located on the left bank of the Columbia River, approximately 10.5 km (6.5 mi) downstream of Grand Coulee Dam. Implementation of a Data Recovery Plan developed for this project resulted in the complete excavation of the housepit (designated House 1) and the sampling of two yard blocks located on the river side of the house depression. The research design for this investigation focused on the construction of House 1, the number of occupants residing in the house, the subsistence strategies represented, the nature of house activity areas and the spatial organization of floor space, and the structure of the household group in residence. Reconstructions of the house suggest a hip or squared roof configuration and confirm multiple occupations. Winter or a fall-winter season of occupation is inferred from analyses of faunal data, even though multiple occupations are most likely nested in all resulting data sets. Relatively high proportions of salmon remains were recovered on the house floor. Comparisons to Hudnut Phase sites/components excavated during the Chief Joseph Dam Cultural Resources Project (CJDCRP) identify a general correspondence in data sets between Hudnut Phase habitations, as well as the variability apparent in these data. Analysis of floor space indicates the presence of up to four residential groups, possibly representing as many as 28 people in residence at any one time. The four residential zones on the floor include a range of domestic activity sets. (Lantz-PTT)
W91-07039

INVESTIGATIONS AT THE CAKE RANCH SITE: A CLASSIC PERIOD HOHOKAM VILLAGE IN THE LOWER SANTA CRUZ RIVER BASIN, PINAL COUNTY, ARIZONA.
Northland Research, Inc., Flagstaff, AZ.
C. D. Halbirt, T. K. Henderson, J. E. Kisselburg, J. W. Gish, and J. Hutira.
February 1990. 186p, 36 fig, 36 tab, 100 ref, 4 append. Bureau of Reclamation Contract No. 3-PA-30-00740.

Descriptors: *Archaeology, *Arizona, *Santa Cruz River Basin, *Water resources development, History, Social aspects.

A description is presented of the results of archaeological investigations undertaken at the Cake Ranch site (AZ AA:7:3 (ASM)). This work occurred prior to the construction of Lateral Segment 5 of the Central Arizona Irrigation and Drainage District South Distribution System. The Cake Ranch site is located approximately 4 km west of the town of Red Rock, Arizona in Pinal County. The site is a large classic period Hohokam village situated adjacent to the Santa Cruz River floodplain. The investigations revealed that the site consists of five probable habitation loci distributed within a 65 acre area. Within the right of way, 30 cultural features were excavated. Documented were adobe-walled pithouses, cremations, and a variety of extramural pits representing activities that included storage, food processing, and cooking. In addition to the 30 cultural features excavated, four other features were found eroding from an entrenched tributary of the Santa Cruz River approximately 400 m south of the right of way within the southern habitation locus. (Author's abstract)
W91-07046

MATHEMATICAL MODEL FOR RESERVOIR SILTING.
Sao Paulo Univ., Sao Carlos (Brazil). Escola de Engenharia.
For primary bibliographic entry see Field 2J.
W91-07062

SILTING OF MOROCCAN DAMS.
Hydraulic Administration, Avenue Hassan Ben Chekroun, Casier Rabat Chellah, Morocco.
For primary bibliographic entry see Field 2J.
W91-07065

7. RESOURCES DATA

7A. Network Design

CHEMICAL EMISSIONS FROM THE PROCESSING AND USE OF MATERIALS: THE NEED FOR AN INTEGRATED EMISSIONS ACCOUNTING SYSTEM.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5G.
W91-06109

EUROPEAN NETWORK OF REPRESENTATIVE AND EXPERIMENTAL BASINS FOR LONG-TERM MONITORING OF WATER RESOURCES.
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
P. Dubreuil.
IN: FRIENDS in Hydrology. IAHS Publication No. 187. International Association of Hydrological Sciences, Washington, DC. 1989. p 391-399, 11 ref.

Descriptors: *Conferences, *Data analysis, *Europe, *Experimental basins, *Hydrologic data, *Model studies, *Monitoring, *Streamflow forecasting, *Water resources management, Cooperation, Data acquisition.

During the first half of the twentieth century, numerous research projects on small catchments were carried out, mainly in North America and northern and western Europe. Many advances in the knowledge of hydrological processes have been obtained through small catchment research. At a meeting in 1986 in Aix-en-Provence (France), 38 scientists from six countries began the implementation of the European research network of experimental research basins (ERBs). The scope of the network was defined based on answers to a questionnaire sent to 11 countries. The second general assembly of the network was held in Perugia (Italy) in 1988. At the end of 1989, nine European countries had designated a national correspondent to the network; these are Belgium, France, Germany, Italy, the Netherlands, Portugal, Spain, Switzerland, and the United Kingdom. Due to the importance of land use changes, the Food and Agriculture Organization of the United Nations is cooperating with the network. Future activities of the network hopefully will include implementing agreed-upon common minimum data requirements, joint projects in the areas of erosion and sediment transport processes, and participation in phase two of the FREND (Flow Regimes from Experimental and Network Data) project. (See also W91-06461) (Rochester-PTT)
W91-06499

SELECTION OF REPRESENTATIVE AND EXPERIMENTAL BASINS FOR THE STUDY OF EROSION ON THE SOUTH AMERICAN PLATEAU (CHOIX DE BASSINS REPRESENTATIFS ET EXPERIMENTAUX POUR L'ETUDE DE L'EROSION SUR LE PLATEAU BASALTIQUE SUDAMERICAIN).
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
For primary bibliographic entry see Field 2J.
W91-07075

STRATEGY FOR ORGANIZING A SEDIMENT DATA COLLECTION NETWORK BASED ON THE AVAILABLE HYDROLOGICAL RECORDS FOR A CATCHMENT IN KENYA.
Ministry of Water Development, Mombasa (Kenya).
For primary bibliographic entry see Field 2J.
W91-07077

EXAMINATION OF THE ROLE OF SAMPLING STRATEGIES IN THE STUDY OF SUSPENDED SEDIMENT TRANSPORT.
University Coll., Campbell (Australia). Dept. of Geography and Oceanography.
For primary bibliographic entry see Field 2J.
W91-07086

7B. Data Acquisition

ASSESSING ATRAZINE PERSISTENCE IN SOIL FOLLOWING A SEVERE DROUGHT.
Michigan State Univ., East Lansing. Pesticide Research Center.
For primary bibliographic entry see Field 5A.
W91-05985

ENZYME IMMUNOASSAY FOR THE DETERMINATION OF ATRAZINE RESIDUE IN SOIL.
California Dept. of Food and Agriculture, Sacramento. Environmental Hazards Assessment Program.
For primary bibliographic entry see Field 5A.
W91-05986

TOXICITY TEST WITH ALGAE: A DISCUSSION ON THE BATCH METHOD.
National Swedish Environment Protection Board, Solna.
For primary bibliographic entry see Field 5A.
W91-06002

ADVANCEMENTS IN TOXICITY TESTING APPLIED TO DESIGN AND CONTROL OF BIOLOGICAL PROCESSES.
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W91-06069

IDENTIFICATION OF NON-BIODEGRADABLE, HYDROPHILIC, ORGANIC SUBSTANCES IN INDUSTRIAL AND MUNICIPAL WASTE WATER TREATMENT PLANT-EFFLUENTS BY LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY (LC/MS/MS).
Technische Hochschule Aachen (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
For primary bibliographic entry see Field 5D.
W91-06076

SORPTION OF POLYCYCLIC AROMATIC HYDROCARBONS ONTO NATURAL SOLIDS: DE-

TERMINATION BY FLUORESCENCE QUENCHING METHOD.
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W91-06086

STATIONARY PACKER SYSTEM FOR LAYERWISE GROUNDWATER SAMPLING IN MONITORING WELLS--TECHNIQUE AND RESULTS.
Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
M. Rodelsperger, U. Rohmann, and F. Frimmel.
Water Science and Technology WSTED4, Vol. 23, No. 1/3, p 545-553, 1991. 8 fig, 7 ref. Ministerium fuer Ernaehrung, Landwirtschaft, Umwelt und Forsten grant 75-82 02; Kernforschungszentrum Karlsruhe grant PW 86-038; and Bundesminister fuer Forschung und Technologie grant 02-WT-436.

Descriptors: *Groundwater quality, *Monitoring, *Monitoring wells, *Samplers, *Water sampling, *Well packers, Aquifer testing, Pumping tests, Pumps, Water table, Well construction.

A sampling device was designed for use as stationary equipment for deep monitoring wells, to obtain representative groundwater samples from different layers of the aquifer. The device consists of packer units which can be combined at variable distances, allowing adaptation to the local conditions of the aquifer and well construction. The pumps are situated below the groundwater table. Each of the sampling tubes ends between two packers in a selected sampling interval. Experimental results demonstrate the importance of the application of a stationary packer system instead of a mobile double packer in deep aquifers of inhomogeneous structure. Examples of concentration profiles obtained from layerwise groundwater sampling indicate that even after a long pumping period the double packer system does not isolate the packed off interval as well as the stationary system because of upflow from less contaminated water. (Author's abstract)
W91-06098

ERROR STRUCTURE OF MULTIPARAMETER RADAR AND SURFACE MEASUREMENTS OF RAINFALL. PART III: SPECIFIC DIFFERENTIAL PHASE.
Alabama Univ. in Huntsville.
For primary bibliographic entry see Field 2B.
W91-06110

NEW FAST RESPONSE INSTRUMENT FOR MEASURING TOTAL WATER CONTENT FROM AIRCRAFT.
Royal Aerospace Establishment, Farnborough (England).
S. Nicholls, J. Leighton, and R. Barker.
Journal of Atmospheric and Oceanic Technology JAOTES, Vol. 7, No. 5, p 706-718, October 1990. 16 fig, 1 tab, 13 ref.

Descriptors: *Atmospheric water, *Cloud liquid water, *Data acquisition, *Hygrometry, *Instrumentation, *Measuring instruments, *Meteorology, *Moisture content, *Remote sensing, Aircraft, Clouds, Dewpoint, Evaporation, Moisture probe, Precipitation.

A device for measuring the total water content of a parcel of air from an aircraft is described. The total water of a parcel of air is a conserved quantity, independent of phase changes, provided there is no transport of water through the parcel boundaries. Current airborne hygrometers normally attempt to measure the water content in individual phases and the presence of other phases, invariably influences the quality of the data. However, any liquid water or ice entering this new probe is efficiently evaporated and the resultant water vapor measured using a Lyman-alpha hygrometer. The device was calibrated against a cooled-mirror dewpoint device in airborne trials. Runs were conducted in warm stratocumulus tops, through small cumulus, in mixed-phase precipitation and cirrus cloud. In all cases, the device was found to produce high-quality, fast response data. (Author's abstract)
W91-06111

METHOD FOR IMPROVING RAIN ESTIMATES FROM VERTICAL-INCIDENCE DOPPLER RADAR OBSERVATIONS.
Chicago Univ., IL. Lab. for Atmospheric Probing.
R. C. Srivastava.
Journal of Atmospheric and Oceanic Technology JAOTES, Vol. 7, No. 5, p 769-773, October 1990. 4 fig, 1 tab, 17 ref. NSF Grant ATM 89-03683.

Descriptors: *Mathematical studies, *Meteorology, *Radar, *Rain, *Rainfall rate, *Remote sensing, Estimating equations, Reflectivity.

A method was developed for improving estimates of rainfall rate in stratiform rain from vertical incidence observations of the radar reflectivity factor and the mean Doppler velocity and estimates of vertical air velocity obtained by Velocity Azimuth Display or Extended Velocity Azimuth Display. The method assumes an exponential drop size distribution but, unlike conventional methods, does not assume a specific value of the intercept parameter for the distribution. To use the method it is necessary to correct the measured mean Doppler velocity for the effects of vertical air velocity unless the velocity is known to be less than about 0.4m/sec. Two examples of the use of the method are presented. Theoretical studies suggest that raindrop size distribution tends toward an exponential function of constant slope or a function of constant shape, while the radar reflectivity factor, rainfall rate, and rainwater content all tend to be proportional to the intercept parameter. For typical fall distances, these conclusions can apply only at rather high rainfall rates. In stratiform rain, with melting band and a relatively low intensity of rainfall, the method may be used to study the evolution of these parameters and the size distribution with distance fallen. (Doria-PTT)
W91-06112

DEPENDENCE OF REFLECTIVITY FACTOR-RAINFALL RATE RELATIONSHIP ON POLARIZATION.
National Severe Storms Lab., Norman, OK.
For primary bibliographic entry see Field 2B.
W91-06113

LEACHING CHARACTERISTICS OF CONSTRUCTION MATERIALS AND STABILIZATION PRODUCTS CONTAINING WASTE MATERIALS.
Netherlands Energy Research Foundation ECN, Petten.
For primary bibliographic entry see Field 5E.
W91-06136

EVALUATING THE FREEZE-THAW DURABILITY OF PORTLAND CEMENT-STABILIZED-SOLIDIFIED HEAVY METAL WASTE USING ACOUSTIC MEASUREMENTS.
New Hampshire Univ., Durham. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W91-06139

DEVELOPMENT OF A LIQUID RELEASE TESTER.
Chemical Waste Management, Inc., Geneva, IL.
C. P. Swanstrom.
IN: Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes. STP 1033. ASTM, Philadelphia, PA, 1989. p 192-200, 2 fig, 5 tab.

Descriptors: *Landfills, *Liquid release tester, *Measuring instruments, *Testing procedures, *Waste disposal, *Waste solidification, Data acquisition, Field tests, Leaching, Pressure, Solid waste disposal.

The 1984 Amendments to the Resource Conservation and Recovery Act (RCRA) specify that bulk liquid wastes which have been stabilized/solidified for land disposal must not release the liquid under the mechanical pressures experienced in a landfill. How to determine this property has not yet been specified. In response to the need for a simple, yet highly effective test device to evaluate the tendency of a stabilized waste to release liquid, a test apparatus and a test procedure have been developed. This simple tester distinguishes between stabilized wastes which will release liquids under pressure on a pass/fail basis. The tester utilizes a 100 g sample that requires only minimal sample preparation. The test duration is 5 minutes. The only expendables are readily available paper filters, and the system requires only a balance and compressed air for operation. The effects of test pressure, test duration, and sample cure time were evaluated. Results may be compared with other test procedures for evaluating stabilized waste. The equipment quickly produces consistent results that agree with other test methods used to evaluate stabilized wastes. (See also W91-06124) (Lantz-PTT)
W91-06140

COMPARATIVE STUDIES OF METAL CONTAINMENT IN SOLIDIFIED MATRICES BY SCANNING AND TRANSMISSION ELECTRON MICROSCOPY.
Alberta Environmental Centre, Vegreville.
For primary bibliographic entry see Field 5E.
W91-06141

EXPERIMENTAL EVALUATION OF LIMITING FACTORS FOR LEACHING MECHANISM IN SOLIDIFIED HAZARDOUS WASTES.
Aquila Univ. (Italy). Dept. of Chemistry.
For primary bibliographic entry see Field 5E.
W91-06143

COLUMN LEACH TESTING OF PHENOL AND TRICHLOROETHYLENE STABILIZED/SOLIDIFIED WITH PORTLAND CEMENT.
New Hampshire Univ., Durham. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W91-06144

FIELD TESTING OF WASTE FORMS USING LYSIMETERS.
Idaho National Engineering Lab., Idaho Falls. Biotechnology and Waste Management Programs.
For primary bibliographic entry see Field 5E.
W91-06156

WASTE REDUCTION AUDITS: MATCHING TYPES TO STAGES.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 5E.
W91-06162

WASTE MINIMIZATION AUDITS AT INDUSTRIAL AND DOD INSTALLATIONS.
Versar, Inc., Springfield, VA.
For primary bibliographic entry see Field 5E.
W91-06163

HAZARDOUS WASTE MINIMIZATION AUDITS: STRATEGY AND METHODOLOGY.
Environmental Science and Engineering, Inc., Gainesville, FL.
For primary bibliographic entry see Field 5E.
W91-06164

METHODS FOR MONITORING SOLVENT CONDITION AND MAXIMIZING ITS UTILIZATION.
Air Force Engineering and Services Center, Tyndall AFB, FL.
For primary bibliographic entry see Field 5E.
W91-06166

EFFECT OF CADMIUM ON PROTEIN SYNTHESIS IN GILL TISSUE OF THE SEA MUSSEL MYTILUS EDULIS.

Utrecht Rijksuniversiteit (Netherlands). Dept. of Experimental Zoology.
For primary bibliographic entry see Field 5C.
W91-06189

DRINKING WATER MICROBIOLOGY: PROGRESS AND RECENT DEVELOPMENTS.
For primary bibliographic entry see Field 5F.
W91-06194

CORRECTED METHOD FOR DRY MATTER DETERMINATION FOR USE IN ANAEROBIC DIGESTER CONTROL.
Guelph Univ. (Ontario). School of Engineering.
For primary bibliographic entry see Field 5D.
W91-06223

INDOOR SOIL EROSION RESEARCH FACILITY.
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W91-06232

DEVICE FOR AUTOMATIC SOIL MOISTURE CONTROL AND REGISTRATION OF WATER USE IN POT EXPERIMENTS.
Instituut voor Oecologisch Onderzoek, Heteren (Netherlands).
For primary bibliographic entry see Field 3F.
W91-06313

VERTICALLY INSTALLED, FLUSH-MOUNTED TENSIOMETER FOR TURFGRASS RESEARCH.
Kansas State Univ., Manhattan. Dept. of Horticulture.
R. E. Gaussoin, J. A. Murphy, and B. E. Branham.
Horticultural Science, Vol. 25, No. 8, p 928-929, 1990. 2 fig, 6 ref.

Descriptors: *Instrumentation, *Soil science, *Soil water potential, *Tensiometers, *Turf grasses, Electrical equipment, Manometers, Roots.

The use of tensiometers for development of turf soil-water characteristic curves, diurnal soil-water flux, and other important soil-water phenomena has been limited, because of shallow root systems, high installation costs, equipment delicacy, and use of unsafe mercury manometers. A method for measuring soil water potential in field soils was adapted for use in turfgrass soils. The system uses tensiometers installed flush with the soil surface and permits a measuring depth as shallow as 2.5 to 5.0 cm. Water potential within a tensiometer was measured with a portable pressure transducer. Linear relationships between water potential measured with mercury manometers or vacuum gage-equipped tensiometers and the pressure transducer were obtained (r-squared = 0.99 and 0.97, respectively). The system accurately measures soil water potential of turfgrass soils, while permitting routine cultural practices to be performed. (Author's abstract)
W91-06413

MEASUREMENT OF SOIL WATER POTENTIAL.
Gulf Coast Research and Education Center, Bradenton, FL.
For primary bibliographic entry see Field 2G.
W91-06415

CHARACTERIZATION OF FLOCS FOR SOLID/LIQUID SEPARATION PROCESSES.
Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
For primary bibliographic entry see Field 5D.
W91-06438

ADEQUACY OF ANALYTICAL TECHNIQUES TO DETERMINE THE FATE OF POLYELECTROLYTES IN WASTE TREATMENT.
Battelle Columbus Div., OH.
For primary bibliographic entry see Field 5D.
W91-06442

ROLE OF INSTRUMENT TYPE AND ERRORS IN THE CONSTRUCTION OF CATCHMENT WATER BALANCES.
Ulster Univ. at Jordanstown, Newtownabbey (Northern Ireland). Dept. of Computing Science.
For primary bibliographic entry see Field 2E.
W91-06466

TRANSPIRATION OF MATURE STANDS OF SPRUCE (PICEA ABIES (L.) KARST.) AS ESTIMATED BY THE TREE-TRUNK HEAT BALANCE METHOD.
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Inst. of Forest Ecology.
For primary bibliographic entry see Field 2D.
W91-06539

ROLE OF MAGNETIC MEASUREMENTS IN THE DEVELOPMENT OF A RIVER BASIN EROSIONAL HISTORY.
California Univ., Davis. Dept. of Geology.
R. D. La Ven, F. R. Bickner, and P. Fine.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 507-508. 5 ref.

Descriptors: *California, *Channel erosion, *Erosion, *Magnetic studies, *Rivers, Dating, Eel River, History, Soil genesis, Soil profiles, Weathering.

Three types of magnetic measurements have been used in the development of an erosional history of the South Fork of the Eel River in northern California: (1) magnetostratigraphic measurements provide the age dating control necessary to confirm a uniform uplift rate model; (2) susceptibility measurements confirm and refine soil profile descriptions taken in the field and aid in developing a soil development history for the Garberville chronosequence; and (3) citrate-bicarbonate-dithionite (CBD) treatment selectively removes pedogenic ferrimagnetics from the soil. Measurements of magnetic susceptibility on paired untreated and CBD-treated samples demonstrate a time-dependent increase in both relative and absolute concentrations of pedogenic ferrimagnetics, inferring a time-dependent shift in the mineral composition of the magnetic carriers. The virtual geomagnetic poles, combined with the relative degree of soil development and the degree of weathering of clasts in the strata allow the strata's age to be estimated as 105,000 to 110,000 ybp. (See also W91-06570) (Brunone-PTT)
W91-06653

FIELD METHODS USED FOR MONITORING EROSION AND SEDIMENTATION PROCESSES IN STEEPLANDS OF NORTHWESTERN CALIFORNIA, USA.
Redwood National Park, Arcata, CA.
W. Weaver, R. Sonnevil, and R. Klein.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 509-510.

Descriptors: *California, *Erosion, *Field tests, *Instrumentation, *Sedimentation, Block slides, Electrical equipment, Gaging stations, Geomorphology, Gully erosion, Landslides, Mapping, Pore pressure, Rain gages, Redwood Creek Basin, Roads, Sediment sampler, Sediment transport, Stream discharge.

The relatively long, well funded research effort on erosion and sedimentation processes on logged land in the Redwood Creek basin has permitted experimentation and evaluation of a variety of field research methods. The Redwood Creek drainage basin in northwestern California has been widely reported as one of the most rapidly eroding nonglaciated watersheds of its size in North America. On persistently active mass movement features, such as earthflows and forested blockslides, mechanical strip chart recorders and inexpensive solid state data loggers are used to continuously record downslope movement rates. Sensing mechanisms in strip chart water level recorders and custom built 'slope movement indicators' employ electronic multiple-turn potentiometers to monitor downslope movement of landslides. Each mechanism allows various levels of measurement precision. These records are correlated with data from tipping bucket rain gages and a network of inexpensive storage rain gages fitted with overflow containers. Annual movement of selected slides and of slide subunits are monitored by resurveying stake lines and grids of monumented survey points. Piezometric data are used to model the effects of logging roads on pore water pressures beneath road fills in headwater swales. Fluvial erosion has been closely monitored on cutover lands using erosion plots with sediment collection troughs. A variety of continuous stage recorders have been employed to monitor gage height and stream discharge. Gully erosion has been extensively documented by detailed geomorphic mapping on thousands of hectares of logged land. (See also W91-06570) (Brunone-PTT)
W91-06654

TOXICITY OF NITROGEN-CONTAINING AROMATIC COMPOUNDS (NCACS): QUINOLINE AND 4-AZAFLUORENE BEHAVIOR IN AN ESCHERICHIA COLI TEST SYSTEM--EVIDENCE OF MEMBRANE EFFECTS.
Virginia Inst. of Marine Science, Gloucester Point. Div. of Chemistry and Toxicology.
For primary bibliographic entry see Field 5C.
W91-06705

FLOW CYTOMETRIC TECHNIQUES TO ASSESS TOXICITY TO ALGAE.
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W91-06707

STRESS PROTEINS: THEIR DETECTION AND USES IN BIOMONITORING.
Maryland Univ. Baltimore County, Catonsville. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W91-06714

NEW DEVELOPMENTS IN MEASURING BED LOAD BY THE MAGNETIC TRACER TECHNIQUE.
Freie Univ. Berlin (Germany, F.R.). Inst. fuer Physische Geographie.
R. Spieker, and P. Ergenzinger.
IN: Erosion, Transport and Deposition Processes. IAHS Publication No. 189. IAHS Press, Institute of Hydrology, Wallingford, England. 1990. p 169-178, 7 fig, 1 tab, 8 ref.

Descriptors: *Bed load, *Magnetic studies, *Measuring instruments, *Sediment transport, *Tracers, Data acquisition, Estimating techniques, Flow velocity, Geohydrology, In situ tests, Rocks, Sediment load.

Measuring coarse grained bed load transport under natural conditions remains an unsolved problem. The accuracy of bed load measurements when using classical trapping systems, such as the Helly-Smith sampler, is greatly affected by the extreme temporal and lateral transport rate variations that occur naturally, even during steady flow conditions. Other alternatives, for example conveyor belt and vortex bed load traps, involve high expenses and interrupt the transport process at the measuring site. A new technique, the parallel coil magnetic tracer technique is a method for the in situ monitoring of bed load transport. The method requires part of the bed load to be magnetized. Many drainage basins which contain igneous or metamorphic rocks will provide enough bed load material of adequate natural magnetic field intensities to allow the method to be used in many regions of the world. The method permits the detection of individual magnetized pebbles passing

the measuring site. Because of the arrangement of the detectors, coherent noise signals may be recognized and the actual velocity of individual particles determined. Furthermore, the size of the pebbles in motion can be estimated. Problems created when the signals of the pebbles interfere with noise signals can be overcome with better signal analyzing algorithms and error detection/correction schemes for further data processing. (See also W91-06717) (Lantz-PTT)
W91-06729

SOME APPLICATIONS OF CAESIUM-137 IN THE STUDY OF EROSION, TRANSPORT AND DEPOSITION.
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-06730

EFFECT OF ESCAPE REACTIONS ON THE QUANTITATIVE SAMPLING OF GRAVEL STREAM FAUNA.
Biological Station, Lunz am See (Austria).
G. Bretschko.
Archiv fuer Hydrobiologie AHYBA4, Vol. 120, No. 1, p 41-49, November 1990. 1 fig, 7 tab, 12 ref.

Descriptors: *Aquatic animals, *Aquatic insects, *Sampling, *Sediment sampling, *Stream biota, Biological samples, Crustaceans, Larvae, Samplers.

The small-scale disturbances caused by sampling procedure and the consequences for quantitative sampling of stream bed fauna were studied. It was found that by nitrogen freeze coring, sampling artifacts could be avoided by in situ electro-positioning, but only for sediment-dwelling populations. Individuals staying at or near the sediment surface were able to escape sampling in spite of the precautions. Regardless of the severity of the perturbation, escape reactions among insect larvae were most intense among species known to drift very easily. Crustacea did not show this escape behavior, with the possible exception of cyclopoids. In terms of abundance, sampling-induced losses were 3.9+/-0.7% for insect-dominated and 1.0+/-0.6% for crustacea/'worm' (triclads, nematodes and oligochetes) dominated zoobenthic communities from the top 10 cm of the sediment. It is concluded that escape reactions must be taken into account in quantitative sampling using samplers that do not fully close, such as freeze-core devices. (Author's abstract)
W91-06753

SOIL ELECTRICAL CONDUCTIVITY: EFFECTS OF SOIL PROPERTIES AND APPLICATION TO SOIL SALINITY APPRAISAL.
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 2G.
W91-06789

LOCATING LAGOON SEEPAGE WITH RADAR AND ELECTROMAGNETIC SURVEY.
Clemson Univ., SC. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W91-06801

DETERMINATION OF TOTAL MERCURY CONCENTRATION IN WASTEWATER BY CONTINUOUS MICROFLOW ANALYSIS WITH COLD VAPOR ATOMIC ABSORPTION SPECTROMETRY.
Nagoya Univ. (Japan). Dept. of Applied Chemistry.
For primary bibliographic entry see Field 5A.
W91-06822

TRANSFORMATION OF ALACHLOR BY MICROBIAL COMMUNITIES.
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
H. L. Sun, T. J. Sheets, and F. T. Corbin.
Weed Science WEESA6, Vol. 38, No. 4/5, p 416-420, 1990. 3 fig, 2 tab, 28 ref.

Descriptors: *Alachlor, *Biodegradation, *Fate of pollutants, *Herbicides, Carbon radioisotopes, Culturing techniques, Isotopic tracers, Microbial degradation, Mineralization, Water pollution prevention.

A mixed microbial culture able to transform alachlor at a concentration of 50 microg/ml was obtained from alachlor treated soil after an enrichment period of 84 days. The microbial community was composed of seven strains of bacteria. No single isolate was able to utilize alachlor as a sole source of carbon. There was no alachlor left in the enriched culture after a 14 day incubation, but only 12 % of the C 14-ring labeled alachlor was converted to C-14 dioxide through ring cleavage during 14 days in the basal medium amended with alachlor as a sole carbon source. The presence of sucrose as an alternative carbon source decreased the mineralization potential of the enriched culture, but sucrose increased the mineralizing ability of a three-member mixed culture. Thin-layer chromatographic analysis showed that there were four unidentified metabolites. The absence of a noticeable decline in radioactivity beyond the initial 12 % suggested that the side chain of alachlor was utilized as carbon source by the enriched culture. Little difference in radioactivity between growth medium and cell-free supernatant of the growth medium suggested that the carbon in the ring was not incorporated into the cells of the degrading microorganisms. (Author's abstract)
W91-06829

APPLICATION OF MARINE SEISMIC PROFILING TO A GROUND WATER CONTAMINATION STUDY, ABERDEEN PROVING GROUND, MARYLAND.
Geological Survey, Towson, MD.
For primary bibliographic entry see Field 5B.
W91-06849

USE OF A STANDPIPE TO EVALUATE GROUND WATER SAMPLERS.
Geological Survey, Stennis Space Center, MS.
D. Y. Tai, K. S. Turner, and L. A. Garcia.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 125-132, Winter 1991. 1 fig, 7 tab, 11 ref.

Descriptors: *Data acquisition, *Groundwater pollution, *Samplers, *Standpipes, Chlorinated hydrocarbons, Comparison studies, Gas chromatography, Organic compounds, Performance evaluation, Vertical distribution.

A standpipe system was developed for testing the reliability of groundwater samplers. The unit consists of a stainless steel pipe 5 inches (13 cm) in diameter and 100 feet (30.5 m) in height. It has 14 sampling points from which control samples can be withdrawn at the same time and position as the samples are collected by a sampler lowered to that position. Test solutions were made in two mixing tanks, totaling 260 gallons (980 L), by diluting the concentrate of five volatile chlorohydrocarbons in water at two levels of concentration: 10-to-30 and 100-to-200 parts per billion (micrograms per liter). A gas chromatograph interfaced with a purge-and-trap system was used to perform the analyses. Comparisons of the control samples with the sampler-collected samples have indicated that the three non-pumping samplers had recoveries in the range of 92.4 to 103.5 percent and the three pumping samplers had recoveries ranging from 97.7 to 101.5 percent. (Author's abstract)
W91-06853

TRACING THE INFLUX OF SEWAGE FROM A LEAKY SEWER INTO A VERY THIN AND FAST-FLOWING AQUIFER.
Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wasserguetewirtschaft und Gesundheitsingenieurwesen.
For primary bibliographic entry see Field 5B.
W91-06867

NEW TOXICITY TESTING METHOD USING MARINE BACTERIVOROUS NANOFLAGELLATES.
Biologische Anstalt Helgoland (Germany, F.R.)
For primary bibliographic entry see Field 5C.
W91-06885

MORPHOLOGICAL ASSESSMENT OF SOIL MICROTOPOGRAPHY USING A DIGITAL ELEVATION MODEL ON ONE SQUARE METRE PLOTS.
Centre de Recherches de Rennes (France). Lab. de Science du Sol.
For primary bibliographic entry see Field 2E.
W91-06904

IMPORTANCE OF SOIL WATER CONTENT WHEN ESTIMATING SOIL MICROBIAL C, N AND P BY THE FUMIGATION-EXTRACTION METHODS.
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 2G.
W91-06961

COLOR CHANGES OF ORGANIC WASTES DURING COMPOSTING AND MATURATION PROCESSES.
Centro de Edafologia y Biologia Aplicada del Segura, Murcia (Spain).
For primary bibliographic entry see Field 5E.
W91-06971

METHOD FOR MONITORING THE DECOMPOSITION PROCESS IN SOIL OF ORGANIC WASTEWATERS WITH HIGH STRENGTH AND LOW C/N RATIO.
Tokyo Inst. of Tech. (Japan). Research Lab. of Resources Utilization.
For primary bibliographic entry see Field 5E.
W91-06978

IMMUNOASSAYS TO DETECT AND QUANTITATE HERBICIDES IN THE ENVIRONMENT.
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5A.
W91-06990

INDIRECT INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION DETERMINATION OF FLUORIDE IN WATER SAMPLES BY FLOW INJECTION SOLVENT EXTRACTION.
National Research Inst. for Pollution and Resources, Yatabe (Japan).
J. I. Manzoori, and A. Miyazaki.
Analytical Chemistry ANCHAM, Vol. 62, No. 22, p 2457-2460, November 15, 1990. 4 fig, 3 tab, 17 ref.

Descriptors: *Analytical methods, *Chemical analysis, *Emission spectrometry, *Fluorides, *Solvent extraction, *Water analysis, Laboratory methods, Pollutant identification, Spectral analysis, Spectrophotometry.

An indirect determination of fluoride in water by inductively coupled plasma atomic emission spectrometry combined with flow injection coupled with solvent extraction is reported. A manifold for rapid determination of fluoride has been designed that uses a single coil for complex formation and extraction. The method involves the formation of lanthanum/allzarin complexone/fluoride complex and its extraction into hexanol containing N,N-diethylaniline. The concentration of fluoride is determined indirectly by introduction of the organic layer into the plasma and measurement of emission intensity of the La II 333.75-nm line. The optimum experimental conditions for the determination are described. A coiled groove phase separator fitted iwth a grid and PTFE porous membrane was used in this work. The sampling rate was 36 samples per hour and the callibration graphs were linear from 0.03 to 1.3 micrograms/mL. The relative standard deviation found was 2.16% for 200 microliters of 1 microgram/mL of fluoride. The method is selective and has been applied satisfactorily to the de-

termination of fluoride in water samples. (Author's abstract)
W91-07011

CONCENTRATION OF ORGANICS FROM AQUEOUS SOLUTIONS USING UNCOATED CAPILLARY COLUMNS.
Houston Univ., TX. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W91-07012

DEVELOPMENT OF A NOVEL MULTI-ELEMENT DETECTION SYSTEM FOR TRACE METAL DETERMINATION BASED ON CHEMILUMINESCENCE AFTER SEPARATION BY ION CHROMATOGRAPHY.
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W91-07015

CONCENTRATION AND DETERMINATION OF TRACE AMOUNTS OF CHLORINATED PESTICIDES IN AQUEOUS SAMPLES.
Nottingham Polytechnic (England). Dept. of Physical Sciences.
For primary bibliographic entry see Field 5A.
W91-07017

APPLICATION OF AUGER ELECTRON SPECTROSCOPY TO STUDIES OF CHEMICAL WEATHERING.
Montana State Univ., Bozeman. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2K.
W91-07035

GEOHYDROLOGY AND SIMULATION OF GROUND-WATER FLOW IN THE '400-FOOT,' '600-FOOT,' AND ADJACENT AQUIFERS, BATON ROUGE AREA, LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W91-07047

APPLICATIONS OF REMOTE SENSING TECHNIQUES FOR THE INVENTORY AND MONITORING OF ENVIRONMENTAL POLLUTION.
Geofax B.V., Oldenzaal (Netherlands).
J. Azam.
Available from the National Technical Information Service, Springfield, VA 22161, as N89-25497. Price codes: A03 in paper copy, A01 in microfiche. 29p, 10 fig, 6 ref.

Descriptors: *Aerial photography, *Monitoring, *Path of pollutants, *Remote sensing, Data acquisition, Environmental quality, Groundwater pollution, Groundwater quality, Hazardous wastes, Infrared imagery.

The presence of hazardous wastes leads to a certain degree of risk for human and animal populations. The actual occurrence of ground pollution, and many of the pollution promoting factors are readily identifiable on remotely sensed images. Three sites at where ground investigations had been previously conducted were selected as test sites to evaluate the viability of remote sensing techniques. Color-infrared and panchromatic black and white aerial photographs of various scales and age were used. Both large-scale panchromatic black and white and color infrared photographs were extremely useful for the inventory of environmental pollution. The results of field investigations confirmed the reliability of interpretation to be sufficiently high for operational applications of remote sensing for ground investigations related to environmental pollution. (Author's abstract)
W91-07052

MONITORING PROGRAMME OF SEDIMENT TRANSPORT IN NORWEGIAN RIVERS.
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
For primary bibliographic entry see Field 2J.
W91-07074

METHOD FOR DETERMINING SEDIMENT BUDGETS USING CAESIUM-137.
Australian Nuclear Science and Technology Organisation, Sutherland.
For primary bibliographic entry see Field 2J.
W91-07076

DEVELOPMENT AND FLUME CALIBRATION OF A NEW TYPE OF NEAR-STREAMBED SUSPENDED LOAD SAMPLER.
Chengdu Univ. of Science and Technology (China). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 2J.
W91-07081

ESTIMATING EROSION USING CAESIUM-137: I. MEASURING CAESIUM-137 ACTIVITY IN A SOIL.
University of New England, Armidale (Australia). Dept. of Resource Engineering.
For primary bibliographic entry see Field 2J.
W91-07082

ESTIMATING EROSION USING CAESIUM-137: II. ESTIMATING RATES OF SOIL LOSS.
University of New England, Armidale (Australia). Dept. of Resource Engineering.
For primary bibliographic entry see Field 2J.
W91-07083

MANAGEMENT OF SEDIMENT MONITORING AT THE DRAIX EXPERIMENTAL BASINS (LA GESTATION DU BASSIN VERSANT EXPERIMENTAL DE DRAIX POUR LA MESURE DE L'EROSION).
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Saint-Martin d'Heres (France). Grenoble Group.
For primary bibliographic entry see Field 2J.
W91-07085

EXAMINATION OF THE ROLE OF SAMPLING STRATEGIES IN THE STUDY OF SUSPENDED SEDIMENT TRANSPORT.
University Coll., Campbell (Australia). Dept. of Geography and Oceanography.
For primary bibliographic entry see Field 2J.
W91-07086

TECHNIQUES FOR ESTABLISHING SUSPENDED SEDIMENT SOURCES IN TWO DRAINAGE BASINS IN DEVON, UK: A COMPARATIVE ASSESSMENT.
Hong Kong Univ. Dept. of Geography and Geology.
For primary bibliographic entry see Field 2J.
W91-07087

PRELIMINARY ESTIMATE OF BED LOAD USING MEAN GRAIN SIZE DISTRIBUTION DATA.
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
For primary bibliographic entry see Field 2J.
W91-07089

USE OF CAESIUM-137 MEASUREMENTS TO INVESTIGATE SEDIMENT DELIVERY FROM CULTIVATED AREAS IN DEVON, UK.
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-07093

7C. Evaluation, Processing and Publication

APPLICATION OF WATER-QUALITY STANDARDS TO UK BATHING WATERS.
Saint David's Univ. Coll., Lampeter (Wales). Centre for Research into Environment and Health.
For primary bibliographic entry see Field 5G.
W91-05970

FIELD CALIBRATION OF SURFACE: A MODEL OF AGRICULTURAL CHEMICALS IN SURFACE WATERS.
Monsanto Agricultural Co., St. Louis, MO.
For primary bibliographic entry see Field 5A.
W91-06007

MANAGEMENT IMPLICATIONS OF A MODEL OF PREDATION BY A RESIDENT FISH ON JUVENILE SALMONIDS MIGRATING THROUGH A COLUMBIA RIVER RESERVOIR.
Oregon Dept. of Fish and Wildlife, Clackamas.
For primary bibliographic entry see Field 8I.
W91-06028

WASTE ALLOCATION MODELS FOR RISK ASSESSMENT OF WATER QUALITY MANAGEMENT IN A RIVER BASIN.
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5G.
W91-06047

WEIGHTED FINITE DIFFERENCE AND BOUNDARY ELEMENT METHODS APPLIED TO GROUNDWATER POLLUTION PROBLEMS.
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W91-06095

NONLINEAR TIDAL WAVES IN A KIND OF ESTUARY WITH GRADUALLY VARYING CROSS-SECTION.
Department of Physical Oceanography and Marine Meteorology, Ocean University of Qingdao, Qingdao, China.
For primary bibliographic entry see Field 2L.
W91-06099

MAPS: A GIS FOR LAND RESOURCE MANAGEMENT IN MONTANA.
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
G. A. Nielsen, J. M. Caprio, P. A. McDaniel, R. D. Snyder, and C. Montagne.
Journal of Soil and Water Conservation JSWCA3, Vol. 45, No. 4, p 450-453, July/August 1990. 3 fig, 22 ref.

Descriptors: *Computer programs, *Geographic information systems, *Geological data, *Land use, *Mapping, *Nonpoint pollution sources, *Resources management, *Water pollution sources, *Weather data collections, Automation, Catchment areas, Climatology, Data processing, Decision making, Evapotranspiration potential, Geologic mapping, Groundwater pollution, Precipitation, Soil temperature, Soil types, Soil water.

The Montana Agricultural Experiment Station at Montana State University has developed a computer-based geographic information system (GIS) as a tool for summarizing, manipulating, and presenting an ever-expanding land-attribute data base. The Montana Agricultural Potentials System (MAPS) is an operational, statewide GIS that displays any combination of almost 200 climatic, physiographic, land use, and soil attributes on Albers equal area maps at several scales. MAPS has been used to identify agricultural areas in Montana where potential exists for nonpoint-source pollution of groundwater through percolation. Selected environmental attributes were used to predict percolation potential on annual cropland; this was related to soil available water-holding capacity and the difference between precipitation and potential evapotranspiration for November through June. This map has helped to target areas where problems may exist, increased public awareness of potential

problems, and indicated areas where research efforts should be focused. Data contained in MAPS have been available to the public through interactive software packages. (Doria-PTT)
W91-06115

FINITE ELEMENT MODEL OF CIRCULATION IN SHALLOW WATER WITH MOVING BOUNDARY ON TIDAL-FLAT.
Institute of Marine Environmental Protection, Dalian (China).
For primary bibliographic entry see Field 2L.
W91-06218

CUBIC-SPLINE INTERPOLATION IN LAGRANGIAN ADVECTION COMPUTATION.
Tennessee Valley Authority, Norris. Engineering Lab.
For primary bibliographic entry see Field 5B.
W91-06298

SOIL WATER ASSESSMENT MODEL FOR SEVERAL CROPS IN THE HIGH PLAINS.
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W91-06399

FRIENDS IN HYDROLOGY.
For primary bibliographic entry see Field 2E.
W91-06461

FREND (FLOW REGIMES FROM EXPERIMENTAL AND NETWORK DATA): THE FIRST ONE HUNDRED DAYS.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06462

REVIEW ON THE SMALL HYDROLOGICAL BASINS IN FINLAND.
Environmental Protection Service, Jerusalem (Israel).
For primary bibliographic entry see Field 2E.
W91-06463

OPTIMAL FILTERING TECHNIQUES IN FLOOD FORECASTING.
Sri Lanka Univ., Peradeniya. Hydraulics Lab.
For primary bibliographic entry see Field 2E.
W91-06464

ROLE OF INSTRUMENT TYPE AND ERRORS IN THE CONSTRUCTION OF CATCHMENT WATER BALANCES.
Ulster Univ. at Jordanstown, Newtownabbey (Northern Ireland). Dept. of Computing Science.
For primary bibliographic entry see Field 2E.
W91-06466

APPLICATION OF THE WEST GERMAN IHP RECOMMENDATIONS FOR THE ANALYSIS OF DATA FROM SMALL RESEARCH BASINS.
Freiburg Univ. (Germany, F.R.). Inst. fuer Physische Geographie.
For primary bibliographic entry see Field 2E.
W91-06467

RIVERFLOW PREDICTION DURING BASEFLOW RECESSION ON SOME BRITISH HARD ROCK CATCHMENTS.
Loughborough Univ. of Technology (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W91-06468

USE OF THE FLOW RECESSION CURVE FOR THE ESTIMATION OF CONDITIONS OF RIVER SUPPLY BY UNDERGROUND WATER.
Akademia Rolnicza, Wroclaw (Poland). Inst. of Hydro- and Geotechnics.
For primary bibliographic entry see Field 2E.
W91-06469

COMPUTER-AIDED ANALYSIS OF FLOW RECESSIONS AND COUPLED BASIN WATER BALANCE INVESTIGATIONS.
Technische Univ., Dresden (German D.R.). Dept. of Water Sciences.
For primary bibliographic entry see Field 2E.
W91-06470

ANALYSIS OF TIME VARIABILITY IN RECESSIONS.
Oslo Univ. (Norway). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06471

FITTING DISTRIBUTIONS TO ANNUAL MINIMUM FLOWS OF DIFFERENT DURATIONS.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06472

CONSISTENT SCALE PARAMETER FOR HYDROLOGICAL STUDIES.
Universite Nationale du Benin, Cotonou. Dept. de Mathematiques.
For primary bibliographic entry see Field 2E.
W91-06473

ANALYSIS AND APPLICATION OF EXPERIMENTAL AND NETWORK DATA FOR DEFINING HYDROLOGIC CHARACTERISTICS OF UPSTREAM FORESTED WATERSHEDS.
Taiwan Forestry Research Inst., Taipei. Watershed Management Div.
For primary bibliographic entry see Field 2E.
W91-06474

PREDICTION OF HYDROLOGICAL SIMILARITY IN THE HUNTER VALLEY, AUSTRALIA.
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 2E.
W91-06475

ASPECTS OF HYDROLOGICAL INTERPOLATION WITH THE HELP OF GIS.
Hydroconsult A.B., Uppsala (Sweden).
For primary bibliographic entry see Field 2E.
W91-06476

CHARACTERIZATION OF WATERSHEDS BY THE INTEGRATION OF REMOTE SENSING AND CARTOGRAPHIC DIGITAL DATA.
Faculte des Sciences Agronomiques de l'Etat, Gembloux (Belgium). Lab. de Teledetection et d'Hydraulique Agricole.
For primary bibliographic entry see Field 2E.
W91-06477

HYDROLOGY OF MOUNTAINOUS AREAS: SCIENTIFIC PROBLEM AND A FIELD OF INTERNATIONALLY COORDINATED RESEARCH.
Slovenska Akademia Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky.
For primary bibliographic entry see Field 2E.
W91-06478

APPLICATION OF REGIONAL FLOOD FREQUENCY ANALYSIS TO BASINS IN NORTHWEST EUROPE.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06479

REGIONS ARE DEAD: LONG LIVE THE REGIONS: METHODS OF IDENTIFYING AND DISPENSING WITH REGIONS FOR FLOOD FREQUENCY ANALYSIS.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06480

APPLICATIONS OF REGIONAL FLOOD FREQUENCY PROCEDURES IN IRELAND.
Irish National Committee for IHP, c/o Office of Public Works, Dublin.
For primary bibliographic entry see Field 2E.
W91-06481

APPLICATION OF GIUH AND DIMENSIONLESS HYDROGRAPH MODELS TO UNGAGED BASINS.
Warsaw Univ. (Poland). Faculty of Geography and Regional Studies.
For primary bibliographic entry see Field 2E.
W91-06482

LOW FLOW REGIMES OF NORTHERN AND WESTERN EUROPE.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06483

REGIONAL ANALYSIS OF FLOW DURATION CURVES.
Fachhochschule Nordostniedersachsen, Suderburg (Germany, F.R.). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W91-06484

CHANGING FREQUENCY OF EXTREME HYDROLOGICAL EVENTS IN NORTHERN AND WESTERN EUROPE.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06486

STUDY ON THE EFFECT OF CHANGES OF GROUNDWATER LEVELS ON SOIL MOISTURE CONDITION AND EVAPOTRANSPIRATION.
Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology.
For primary bibliographic entry see Field 2F.
W91-06488

TESTS AND APPLICATION OF SOIL MOISTURE DEFICIT MODELS USED FOR ANALYSIS OF BASIN BEHAVIOUR.
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
For primary bibliographic entry see Field 2E.
W91-06489

FOREST CUT AND FOREST REGENERATION EFFECTS ON WATER BALANCE AND RIVER RUNOFF.
Gosudarstvennyi Gidrologicheskii Inst., Valdai (USSR).
For primary bibliographic entry see Field 2E.
W91-06490

APPLICATION OF A LUMPED CONCEPTUAL MODEL TO FREND CATCHMENTS.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06492

POSSIBILITY OF MATHEMATICAL MODEL APPLICATION TO EVALUATE MAN'S ACTIVITY EFFECTS ON RAINFALL RUNOFF HYDROGRAPH.
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
For primary bibliographic entry see Field 2E.
W91-06493

NEAR SURFACE HYDROLOGICAL PROCESSES UNDER CHANGING LAND USE IN HUMID-EQUATORIAL CONDITIONS.

National Univ. of Singapore.
For primary bibliographic entry see Field 4C.
W91-06494

ESTIMATION OF RIVER FLOWS WITH PARTICULAR REFERENCE TO NATURAL AND ARTIFICIAL COMPONENTS.
Severn-Trent Water Authority, Solihull (England). Rivers and Regulation Div.
For primary bibliographic entry see Field 2E.
W91-06496

FREND RESEARCH PROGRAMME: CONCLUSIONS AND RECOMMENDATIONS.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W91-06497

INTERNATIONAL CO-OPERATION ON HYDROLOGY OF THE CENTRAL AND EASTERN EUROPEAN COUNTRIES.
Warsaw Univ. (Poland). Faculty of Geography and Regional Studies.
For primary bibliographic entry see Field 2E.
W91-06498

FLOOD-CALCULATIONS IN NORWAY.
Norges Vassdrags- og Elektrisitetsvesen, Oslo. Hydrological Div.
For primary bibliographic entry see Field 2E.
W91-06502

RESEARCH DRAINAGE BASIN OF THE REAL COLLOBRIER (MEDITERRANEAN FRANCE): FLOW MODELIZATION AND REGIONAL ANALYSIS.
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Aix-en-Provence (France). Aix-en Provence Group.
For primary bibliographic entry see Field 2E.
W91-06503

FREQUENCY ANALYSIS OF FLOOD AND LOW FLOW.
Water and Environment Research Inst., Helsinki (Finland).
For primary bibliographic entry see Field 2E.
W91-06504

LOW FLOW ANALYSIS.
Norges Vassdrags- og Elektrisitetsvesen, Oslo. Hydrological Div.
For primary bibliographic entry see Field 2E.
W91-06505

MODELLING THE EFFECTS OF ACID DEPOSITION IN A PEATY CATCHMENT IN FINLAND.
Water and Environment Research Inst., Helsinki (Finland).
For primary bibliographic entry see Field 5C.
W91-06506

NTNF--PROGRAMME ON ENVIRONMENTAL IMPACTS ('MVU'): RESEARCH AND REFERENCE CATCHMENTS PROJECT ('FORSK-REF').
Oslo Univ. (Norway). Lab. for Freshwater Ecology and Inland Fisheries.
For primary bibliographic entry see Field 4C.
W91-06507

REGIONAL HYDROLOGY: APPLICATIONS OF INFORMATION TECHNOLOGY.
Oslo Univ. (Norway). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W91-06508

TIME-LAPSE STREAMFLOW OVER NORTH AMERICA.
Time-Lapse Systems, Inc., Seattle, WA.
For primary bibliographic entry see Field 2E.
W91-06509

APPLICATION OF TIME-SERIES MODELLING TO SHORT-TERM STREAMWATER ACIDIFICATION IN UPLAND SCOTLAND.
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W91-06517

EFFECTS OF WHOLE-TREE CLEARCUTTING ON STREAMFLOW CAN BE ADEQUATELY ESTIMATED BY SIMULATION.
Northeastern Forest Experiment Station, Durham, NH. Forestry Sciences Lab.
For primary bibliographic entry see Field 4C.
W91-06564

DYNAMIC MODEL OF SLOPE STABILITY IN ZERO-ORDER BASINS.
Forest Service, Logan, UT. Intermountain Research Station.
For primary bibliographic entry see Field 2J.
W91-06580

TERRAIN ANALYSIS FOR QUANTITATIVE DESCRIPTION OF ZERO-ORDER BASINS.
Queen Mary Coll., London (England). Dept. of Geography and Earth Science.
For primary bibliographic entry see Field 2J.
W91-06582

COMPUTER SIMULATIONS OF DEBRIS FLOW DEPOSITIONAL PROCESSES.
Public Works Research Inst., Tsukuba (Japan).
For primary bibliographic entry see Field 2J.
W91-06591

ASSESSMENT OF TRANSFERABILITY OF USLE TO TAIWAN.
National Chunghsing Univ., Taichung (Taiwan).
For primary bibliographic entry see Field 2J.
W91-06601

CRITICAL CONDITIONS FOR BED MATERIAL MOVEMENT IN STEEP, BOULDER-BED STREAMS.
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W91-06618

LICHENOMETRIC DATING APPLIED TO FLOOD DEPOSITS.
Freshwater Biological Association, Ambleside (England).
P. A. Carling.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 395-396. 1 fig, 1 ref.

Descriptors: *Dating, *Deposition, *Flood discharge, *Gravel, *Lichens, *Paleohydrology, Model studies, Plant growth.

The use of lichens to determine the absolute or relative age of gravel deposits is now commonplace. Such a method was used to produce a growth curve to date flood gravels in the Pennines in northern England. Data for constructing a maximum growth curve were obtained from Huilia albocaerulescens specimens on dated sandstone gravestones. The principle assumed in fitting the maximum growth curve is that, for any datable micro-environment, a data suite can be assembled which consists of a number of individual thalli which, because of favorable circumstances, have grown to a maximum diameter for their age. The curve-fitting approach adopted is a non-parametric maximum likelihood method whereby an unknown mixing distribution is introduced to account for the spread of the data points below a hypothetical linear maximum. The solution is similar to an eye-fitted line, but has been obtained as objectively as is currently practiced. The curve is acceptable over the data range representing the 'growth period' but should not be extrapolated. The curve was satisfactory for dating flood gravel deposits whose age fell within the linear phase of lichen growth. The diameters of the five largest lichens on the flood deposit were averaged. The curve provided a date of 1882 whilst the largest lichen indicated the deposits could be as old as 1846. Contemporary newspaper reports record a flood on March 9, 1881 in the catchment which contains the dated gravels and, therefore, it seems reasonable to ascribe this date to the deposits. (See also W91-06570) (Brunone-PTT)
W91-06630

ENVIRONMENTAL RISK ASSESSMENT/ENVIRONMENTAL HAZARD ASSESSMENT: SIMILARITIES AND DIFFERENCES.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W91-06692

USE OF HAZARD MODELS IN EVALUATING THE EFFECT OF EXPOSURE DURATION ON THE ACUTE TOXICITY OF THREE PESTICIDES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5C.
W91-06708

MODEL FOR EXCHANGE OF ORGANIC CHEMICALS AT FISH GILLS: FLOW AND DIFFUSION LIMITATIONS.
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5B.
W91-06747

3-D MAPPING OF DISSOLVED OXYGEN IN MAR PICCOLO: A CASE STUDY.
Support Group, Fremont, CA.
For primary bibliographic entry see Field 5C.
W91-06802

SEA LEVEL VARIABILITY IN LONG ISLAND SOUND.
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2L.
W91-06833

EFFECTS OF MEASUREMENT ERROR ON PREVIOUSLY REPORTED MATHEMATICAL RELATIONSHIPS BETWEEN INDICATOR ORGANISM DENSITY AND SWIMMING-ASSOCIATED ILLNESS: A QUANTITATIVE ESTIMATE OF THE RESULTING BIAS.
State Univ. of New York at Brooklyn.
J. M. Fleisher.
International Journal of Epidemiology IJEPBF, Vol. 19, No. 4, p 1100-1106, December 1990. 5 tab, 22 ref.

Descriptors: *Bioindicators, *Error analysis, *Human diseases, *Recreation, *Swimming, *Water pollution effects, Bacteria, Computers, Epidemiology, Experimental design, Mathematical analysis, Municipal wastewater, Population density, Sampling, Simulation analysis, Spatial distribution, Temporal distribution, Water quality.

Epidemiological studies seeking associations between swimming in waters contaminated with sewage and increased illness among swimmers often report mathematical relationships relating indicator organism densities to illness. Design of these studies fails to control adequately for large amounts of measurement error contained in exposure estimates (estimated indicator organism densities), resulting in a significant amount of bias in the reported mathematical relationships. To explore this bias, computer simulations were conducted using data in which estimation of indicator organism density was obtained by the two most widely used techniques of enumeration: the Multiple Tube

Fermentation Technique and the Membrane Filtration Technique. Results show that the bias caused by this measurement error is nondifferential, causing the mathematical relationships between indicator organism density and swimming-associated illness to underestimate true risk by a minimum of approximately 14%, and by as much as approximately 57%. This study also demonstrates that substantial reduction of this bias can easily be accomplished by incorporating a formal water quality sampling strategy, based on statistical principles of experimental design and analysis, into the design of future epidemiological studies of this type. (Author's abstract)
W91-06917

COMPUTATION (INVESTIGATION, EDUCATION, AND APPLICATION).
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8B.
W91-07027

SURFACE-WATER QUALITY IN THE WEST BRANCH SUSQUEHANNA RIVER BASIN, PENNSYLVANIA: AN APPRAISAL OF AREAL AND TEMPORAL VARIABILITY FROM 1962 TO 1982 IN HYDROLOGIC ACCOUNTING UNIT 020502.
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5G.
W91-07043

TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. CHAPTER B4: REGRESSION MODELING OF GROUND-WATER FLOW.
For primary bibliographic entry see Field 2F.
W91-07044

EFFECTS OF HETEROGENEOUS POROUS GEOLOGY ON GROUNDWATER FLOW AND TRANSPORT MODELING IN MULTIAQUIFER SYSTEMS.
Savannah River Lab., Aiken, SC.
For primary bibliographic entry see Field 2F.
W91-07053

SEDIMENT BUDGETS.
For primary bibliographic entry see Field 2J.
W91-07057

METHODS OF ESTIMATING BED LOAD TRANSPORT RATES APPLIED TO EPHEMERAL STREAMS.
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W91-07069

SUSPENDED SEDIMENT ROUTING ALONG A RESERVOIR.
Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ingenieria.
For primary bibliographic entry see Field 2J.
W91-07070

ANALYTICAL EVALUATION OF BED LOAD TRANSPORT IN A RIVER SUBJECT TO BACKWATER EFFECT: THE CASE OF THE RIVER TROMBETAS.
ENGE-RIO, Engenharia e Consultoria S/A, Departamento Engenharia Civil, Setor Comercial Norte, Quadra 6, Conj. A, Super Center Venancio 3000, Sala 601, B1.A, Brasilia/DF, CEP: 70710, Brazil.
For primary bibliographic entry see Field 2J.
W91-07072

EVALUATION OF LONG TERM SUSPENDED SEDIMENT RECORDS FOR SELECTED CANADIAN RIVERS.
Environment Canada, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 2J.
W91-07078

ANALYSIS OF THE QUALITY OF SUSPENDED SEDIMENT DATA.
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Recherches Hydrauliques.
For primary bibliographic entry see Field 2J.
W91-07090

MEASURING SEDIMENT YIELDS OF STORMS USING PSALT.
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
For primary bibliographic entry see Field 2J.
W91-07092

RELIABILITY OF RATING CURVE ESTIMATES OF SUSPENDED SEDIMENT YIELD: SOME FURTHER COMMENTS.
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W91-07094

ETA (EROSION TRANSPORT ACCUMULATION) SYSTEMS, THEIR CLASSIFICATION, MAPPING AND MANAGEMENT.
Vrije Univ., Amsterdam (Netherlands). Dept. of Hydrogeology and Geographical Hydrology.
For primary bibliographic entry see Field 2J.
W91-07100

SIMULATION MODEL FOR THE COMPUTATION OF SEDIMENT YIELD DUE TO UPLAND AND CHANNEL EROSION FROM A LARGE BASIN.
Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. for Hydromechanics.
For primary bibliographic entry see Field 2J.
W91-07105

US NATIONAL PROJECT TO DEVELOP IMPROVED EROSION PREDICTION TECHNOLOGY TO REPLACE THE USLE.
Agricultural Research Service, Tucson, AZ.
For primary bibliographic entry see Field 2J.
W91-07107

CHANNEL SEDIMENT BEHAVIOUR AS A BASIS FOR MODELLING DELIVERY PROCESSES.
New South Wales Univ., Kensington (Australia). School of Geography.
For primary bibliographic entry see Field 2J.
W91-07113

APPLICATION OF TWO PHYSICALLY-BASED SEDIMENT YIELD MODELS AT PLOT AND FIELD SCALES.
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W91-07117

8. ENGINEERING WORKS

8A. Structures

DROWNPROOFING OF LOW OVERFLOW STRUCTURES.
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8B.
W91-06294

DAM SAFETY INSPECTION SCHEDULING.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8G.
W91-06295

FLOW IN DAMAGED PIPE NETWORKS.
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Ingenieria.
G. Ayala, and J. A. Liggett.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 230-239, February 1991. 4 fig, 1 tab, 4 ref.

Descriptors: *Damage, *Damaged pipe networks, *Hydraulic engineering, *Pipes, *Water conveyance, *Water delivery, *Water distribution, Algorithms, Head loss, Mechanical failure, Open-channel flow, Pressure conduits.

Water distribution networks are designed so that water is delivered to each node in the system in sufficient quantities and with sufficient pressure for all the design demands. If the system becomes damaged, however, its behavior may be drastically altered. A method of calculating the behavior of the damaged system was developed. An approximate algorithm is proposed to eliminate false negative (gage) pressures that appear during the analysis of a water distribution system. Emphasis is placed on the solution of the problem rather than on its cause. The formulation is based on a system of equations for a network that has been constructed using the continuity equations for each node and the head-loss equations for each pipe. It contemplates two situations: one in which the elimination of a false negative pressure leads to the emptying of all the pipes that join a node, and the other in which the conditions are such that the elimination of the negative pressure leads to one or more pipes flowing partially full as an open channel. Two examples illustrate the applicability of the approximation, one for an imaginary simple network and the other for a water delivery system in a large city. (Author's abstract)
W91-06296

MONITORING WELL COMPLETION EVALUATION WITH BOREHOLE GEOPHYSICAL DENSITY LOGGING.
Colog, Inc., Golden, CO. Borehole Geophysical Services.
For primary bibliographic entry see Field 8G.
W91-06850

8B. Hydraulics

VORTEX-SETTLING BASIN DESIGN CONSIDERATIONS.
Irrigation and Power Research Inst., Amritsar (India).
T. C. Paul, S. K. Sayal, V. S. Sakhuja, and G. S. Dhillon.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 172-189, February 1991. 10 fig, 2 tab, 19 ref.

Descriptors: *Canal design, *Hydraulic design, *Hydraulic engineering, *Sediment control, *Sediments, *Settling basins, Canals, Design criteria, Hydraulic structures, Inlets, Irrigation canals, Suspended sediments.

One of the major problems confronting hydraulic engineers is the control of sediment entering irrigation and power canals. The vortex-settling basin (VSB) is a fluidic device that uses only the vortices of the flow to remove sediment. This is an economical, efficient, and water-conserving alternative to the other available sediment-extraction devices. Guidelines for designing and modeling VSBs have been developed. The circular basin should have a diameter equal to five times (as compared with six times stipulated in American practice) the bed width of the inlet canal. The distinctive features of the proposed design are formation of free vortex in the outer region and flow in the basin traversing a relatively longer path before reaching the overflow weir. Extraction of sediment smaller than 0.5 mm is optimized when a diaphragm and a deflector are incorporated in the inlet canal and basin, respectively. The diameter of the flushing pipe and the flushing discharge to be adopted for the extraction of different sediment fractions are specified. Formulas suggested for prediction of trapping efficiency are simpler and more reliable

than several existing formulas. Experiments indicate 76% utilization of the VSB volume and, therefore, show a better performance compared to standard sediment tanks. (Author's abstract)
W91-06292

DROWNPROOFING OF LOW OVERFLOW STRUCTURES.
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
H. J. Leutheusser, and W. M. Birk.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 205-213, February 1991. 4 fig, 9 ref.

Descriptors: *Fluid mechanics, *Hydraulic engineering, *Hydraulic jump, *Hydraulic structures, *Overflow channels, *Overflow structures, Dams, Design criteria, Hydraulic design, Spillway trough, Weirs.

Overflow structures operating in the subcritical channel regime serve a multitude of purposes. In all types of construction, a properly functioning overflow structure produces a change from subcritical to supercritical flow, and the kinetic energy of the resulting high-velocity stream must then be dissipated, usually by a hydraulic jump. Submergence of hydraulic jumps occurs frequently at low overflow structures, such as weirs and low-head dams. In these cases the jump degenerates into a rotating current that produces a strong upstream-directed surface velocity in an otherwise seemingly quiescent downstream pool. This vortex is commonly called the hydraulic by canoeists and water safety experts who fear and respect its potential to maim and kill, yet the phenomenon is virtually unknown in the hydraulic engineering literature. Using analysis and experimental evidence, it can be shown how the hydraulic is eliminated by either increasing the height of the structure sufficiently to promote formation of a proper hydraulic jump, or by adopting the cascade concept of continuous energy dissipation on a baffled chute. In the case of raising the height of the structure, the required height can easily become so great, however, that it may be deemed unacceptable. On the other hand, baffled-chute spillways are environmentally attractive, known to function well over a wide range of operating conditions, and completely independent of tailwater depth. (Author's abstract)
W91-06294

FIRST-ORDER ANALYSIS OF OPEN-CHANNEL FLOW.
Polytechnic Univ., Brooklyn, NY.
M. A. Cesare.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 242-247, February 1991. 2 fig, 2 tab, 3 ref.

Descriptors: *Design flow, *Discharge forecasting, *Flow equations, *Open-channel flow, *Peak discharge, *Stage-discharge relations, *Streamflow forecasting, Channel flow, Flow characteristics, Flow discharge, Mannings equation, Uncertainty.

Water resources engineering is one of the first fields to use a probability approach to design. It has long been realized that the peak discharge of a river is a random variable. However, the traditional frequency analysis (return period) approach of the water resources design only considers uncertainty in the discharge. First-order reliability methods (FORM) may be used to incorporate the other uncertainties involved in open-channel hydraulics. A comparison of these results to the traditional method in a simple example employing Manning's equation for a compound channel and a Gumbel distribution for design discharges illustrates the advantages of the FORM approach. It can be seen that the return period for a depth of flow is less than the return period for the flow normally associated with that depth. This is because in the direct method no uncertainty is accounted for in Manning's equation, i.e., converting flow to depth. The coefficients of variation used are arbitrary, however, 15% uncertainty is not unreasonable. It can be seen that small coefficients of variation (5%) have almost no effect, but moderate coefficients of variation (15%) cut the return period in half for large storms. Viewing the results for one return period tends to subdue the effect of the additional uncertainty. However, the changes in the return period for a given depth are significant. (Fish-PTT)
W91-06297

COMPUTATION (INVESTIGATION, EDUCATION, AND APPLICATION).
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
J. A. Liggett.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1436-1433, December 1990.

Descriptors: *Computer models, *Data processing, *Hydraulic engineering, *Hydrologic models, *Hydrology, *Model studies, Computer programs, Computers, Education.

Computational hydraulics has become an everyday tool in hydraulic engineering. Although a large number of problems can be solved on the computer, there will always be important applications that lie out of reach. The related difficulties of scale and detail limit what can be done regardless of the computational power. Such problems are illustrated by many applications, especially those that involve turbulence, stratification, groundwater, hydrologic detail and sediment transport. It is important that hydraulic engineers know something about computation, especially what may go wrong and what not to compute. Unfortunately, a large gap exists between research and practice of computational hydraulics. Closure of that gap should be a primary goal of all hydraulic engineers and the American Society of Civil Engineers. In the engineering office, computational hydraulics is rapidly changing the mode of operation. The availability of better communications will have an equal effect. The ultimate importance of knowledge based programs on the profession could drastically alter educational goals and hiring practices. (Author's abstract)
W91-07027

PREDICTING INCIPIENT FLUIDIZATION OF FINE SANDS IN UNBOUNDED DOMAINS.
Lehigh Univ., Bethlehem, PA. Dept. of Civil Engineering.
G. P. Lennon, T. Chang, and R. N. Weisman.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1454-1467, December 1990. 7 fig, 1 tab, 19 ref, 2 append.

Descriptors: *Channel improvement, *Flow models, *Fluidization, *Hydraulic properties, *Model studies, *Porous media, *Pressure head, *Sand, Darcys law, Flow equations, Flow rates, Mathematical models, Reynolds number, Tidal basins.

From the theory of flow through porous media, the governing equation for hydraulic head is developed for flow emanating from small holes in a pipe buried in fine sand in the coastal environment. Calculated Reynolds numbers for sand grain sizes typically found in tidal inlets (less than 0.5 mmm) indicate that the generalized Darcy law remains valid up to fluidization. The head distribution in the domain is obtained from the two-dimensional finite element method and validated with experimental results. The theoretical critical hydraulic gradient is used to predict the incipient fluidization flow rate conditions for the available experimental data as well as for a wide range of field situations. A practical fluidization system chart is developed for determination of the flow rate required for incipient fluidization. For a pipe diameter of 0.3 m, the chart provides flow rates for burial depths ranging between 1.5 and 12.2 m. The head loss through the bed at incipient conditions is 1.9-2.9 times the bed depth for the range of simulated conditions. (Author's abstract)
W91-07028

EFFECT OF BUOYANCY ON TRANSVERSE MIXING IN STREAMS.
Stevens Inst. of Tech., Hoboken, NJ. Dept. of Civil, Environmental and Coastal Engineering.
For primary bibliographic entry see Field 5B.
W91-07030

EFFECTS OF MOMENTUM TRANSFER IN COMPOUND CHANNELS.
University of the Witwatersrand, Johannesburg (South Africa).
D. Stephenson, and P. Kolovopoulos.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 116, No. 12, p 1512-1522, December 1990. 11 fig, 15 ref.

Descriptors: *Channel flow, *Flood plains, *Hydrodynamics, *Momentum transfer, *Shear stress, Flooding, Mathematical equations, Mathematical models, Model studies, Open-channel flow.

Different methods of considering the shear stresses between a main channel and its flood plains are discussed. The methods considered include the simplistic method of considering the entire hydraulic cross section as one, dividing the cross section into independent sections, assuming limited shear stresses between main channel and the flood plain, trying to find an interface with zero shear stress, or allowing for the shear stresses from a momentum balance. Based on evaluation of alternative steady-state models, it is concluded that the area method is the most promising for computation of discharge and that the Prinos-Townsend equation gives accurate results for apparent shear stresses at the main channel-flood plain interface. The results of the theoretical study are used in an unsteady-flow model, prepared based on hydrodynamic principles. The model facilitates investigation of the significance of the momentum-transfer phenomenon between the main channel and its floodplains. The analysis demonstrates that momentum interchange results in a shift in the loop rating curve to the right, a delay in the falling of water levels, an increase in flood plain flow, and a decrease in the main channel carrying capacity. (Author's abstract)
W91-07032

SURGING IN URBAN STORM DRAINAGE SYSTEMS.
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 5D.
W91-07033

SOME FACTORS AFFECTING EROSION OF BED CHANNELS PROTECTED WITH RIPRAP.
Sao Paulo Univ., Sao Carlos (Brazil). Dept. de Hidraulica e Saneamento.
For primary bibliographic entry see Field 2J.
W91-07071

8D. Soil Mechanics

ESTIMATING THE ATTERBERG LIMITS OF SOUTHERN SASKATCHEWAN SOILS FROM TEXTURE AND CARBON CONTENTS.
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
E. De Jong, D. F. Acton, and H. B. Stonehouse.
Canadian Journal of Soil Science CJSSAR, Vol. 70, No. 4, p 543-554, November 1990. 3 fig, 6 tab, 28 ref.

Descriptors: *Atterberg limits, *Canada, *Soil engineering, *Soil properties, *Soil science, *Soil water, Carbon, Clays, Organic carbon, Organic matter, Plasticity, Regression analysis, Saskatchewan, Soil classification, Soil horizons, Soil surveys, Soil texture, Subsoil, Topsoil.

The soil water contents at the liquid and plastic limits (the Atterberg limits) are widely used in the classification of soils for engineering purposes. Approximately 500 soil samples (129 Ap horizons and 417 B and C horizons) collected over several years as part of the ongoing soil survey program in Saskatchewan, Canada, were analyzed for texture and Atterberg limits. On about half of the samples water retention (-33 kPa and -1500 kPa matric

potential and air dryness), and organic and inorganic carbon (C) were also determined. The relationship between the Atterberg limits and soil properties was explored through correlation and regression analysis. It was found that the liquid limit, plastic limit, and plasticity index of A, B, and C horizon samples were most highly correlated with clay content. Organic C was significantly correlated with the liquid limit and the plasticity index, but not the plastic limit of A horizons. Organic C increased the liquid and plastic limits of subsoils, but did not affect their plasticity index. The liquid limit and plastic limit and plasticity index of B and C horizons were reduced by inorganic C. Regression equations of liquid limit, plastic limit and plasticity index on clay, organic, and inorganic C had standard errors of estimate of 4% or larger. The largest errors were associated with the predicted plasticity index, in particular for topsoils. Whether the prediction equations are sufficiently accurate to replace the Atterberg limit determinations is uncertain. Generally, regression equations using the water content studied had somewhat lower standard errors of estimate. Thus, the moisture content at a standard matric or total potential might provide a simple index for the Atterberg limits. (Fish-PTT)
W91-06405

8E. Rock Mechanics and Geology

BEDROCK GEOMETRY OF UNCHANNELIZED VALLEYS.
Humboldt State Univ., Arcata, CA. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W91-06578

8G. Materials

LEACHING AND COMPREHENSIVE REGULATORY PERFORMANCE TESTING OF AN EXTRUDED BITUMEN CONTAINING A SURROGATE, SODIUM NITRATE-BASED, LOW-LEVEL WASTE.
Martin Marietta Energy Systems, Inc., Oak Ridge, TN.
For primary bibliographic entry see Field 5E.
W91-06128

DEVELOPMENT OF A COMPOSITE POLYETHYLENE--FIBERGLASS-REINFORCED-PLASTIC HIGH-INTEGRITY CONTAINER FOR DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE.
Lowenberg Associates, Inc., Rockville, MD.
For primary bibliographic entry see Field 5E.
W91-06131

LEACHING-INDUCED CONCENTRATION PROFILES IN THE SOLID PHASE OF CEMENT.
Brookhaven National Lab., Upton, NY. Nuclear Waste Research Group.
For primary bibliographic entry see Field 5E.
W91-06149

DAM SAFETY INSPECTION SCHEDULING.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
W. H. Tang, and B. C. Yen.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 117, No. 2, p 214-229, February 1991. 11 fig, 10 ref.

Descriptors: *Dam inspection, *Dam safety, *Dams, *Hydraulic engineering, *Inspection, Dam failure, Dam stability, Deterioration, Scheduling.

Safety inspection of dams can be scheduled on a probabilistic basis considering detectability and repair probability. A method of inspection scheduling for a dam is suggested by using an availability model. Unavailability is defined as the state in which a dam is operating under unsatisfactory conditions with deficiencies. The deficiencies may or may not be detected in an inspection, and a detected deficiency may or may not be repaired in due time. The expected availability of a dam may be related to the frequency of dam inspection, the detectability of the inspection routine, the likelihood of owners' compliance to repair orders, and the construction quality of the given dam. The deteriorating characteristics of a dam with time could also affect its availability. The case of inspection scheduling for a nonaging dam is first developed, followed by the case of an aging dam. Hypothetical examples demonstrate the procedure. (Author's abstract)
W91-06295

MONITORING WELL COMPLETION EVALUATION WITH BOREHOLE GEOPHYSICAL DENSITY LOGGING.
Colog, Inc., Golden, CO. Borehole Geophysical Services.
E. N. Yearsley, R. E. Crowder, and L. A. Irons.
Groundwater Monitoring Review GWMRDU, Vol. 11, No. 1, p 103-111, Winter 1991. 10 fig, 12 ref.

Descriptors: *Borehole geophysics, *Boreholes, *Well casings, *Well construction, Measuring instruments, Radioactive well logging, Well logs.

Grout continuity and the location of the bentonite seal and sand pack in PVC-cased monitoring wells can be evaluated with cased-hole geophysical density logs. This method relies upon density contrasts among various completion conditions and annular materials, as measured by Compton-scattered gamma rays originating from a small source in the detector probe. Notably, the lack of annular material behind pipe (i.e., void space) creates a low-density zone that is readily detected by borehole density measurements. Acoustic cement bond logging has typically been applied to the evaluation of cement in annular space of completed oil and gas production wells, and in some cases to groundwater monitoring wells. These logs, however, can only be obtained in the fluid-filled portion of the borehole, and their interpretation is severely hindered by the presence of the micro-annulus between casing and cement. The influence of the micro-annulus on cement bond logs can be mitigated in steel-cased wells by pressurizing the wellbore during acquisition of the log, but this procedure is not feasible in PVC-cased wells. The micro-annulus does not affect case-hole density logs or their interpretation. Empirical measurements made in the laboratory with density probes provide information on their depths of investigation and response to specific completion conditions. These empirical data, and general knowledge of the density of annular completion materials (sand, bentonite, cement), are used to support interpretations of case-hole density logs acquired in the field. In three field examples of geophysical density logs significant voids in grout continuity were found and demonstrate the applicability of this method to the evaluation of PVC-cased monitoring wells. (Author's abstract)
W91-06850

8I. Fisheries Engineering

FISH ASSOCIATIONS AND ENVIRONMENTAL VARIABLES IN AGE-0 COLORADO SQUAWFISH HABITATS, GREEN RIVER, UTAH.
Fish and Wildlife Service, Vernal, UT.
For primary bibliographic entry see Field 2H.
W91-06013

HYDRODYNAMIC AND FLUVIAL MORPHOLOGIC PROCESSES: IMPLICATIONS FOR FISHERIES MANAGEMENT AND RESEARCH.
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
For primary bibliographic entry see Field 2E.
W91-06026

EXCEPTIONAL WATERS APPROACH--A FOCUS FOR COORDINATED NATURAL RESOURCES MANAGEMENT.
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6B.
W91-06027

MANAGEMENT IMPLICATIONS OF A MODEL OF PREDATION BY A RESIDENT FISH ON JUVENILE SALMONIDS MIGRATING THROUGH A COLUMBIA RIVER RESERVOIR.
Oregon Dept. of Fish and Wildlife, Clackamas.
R. C. Beamesderfer, B. E. Rieman, L. J. Bledsoe, and S. Vigg.
North American Journal of Fisheries Management NAJMDP, Vol. 10, No. 3, p 290-304, Summer 1990. 8 fig, 3 tab, 30 ref. Bonneville Power Administration Contracts DE-AI79-82BP34796 and DE-AI79-82BP35097.

Descriptors: *Fisheries management, *Model studies, *Predation, *Salmon, Age class, Distribution, Fish diets, Food habits, John Day Reservoir, Minnow, Reservoirs, Seasonal variation, Sensitivity analysis, Statistical analysis, Temperature.

A model of predation by northern squawfish Ptychoheilus oregonensis on juvenile salmonids migrating through John Day Reservoir was modeled. The model predicts salmonid survival as a function of number and distribution of northern squawfish, number and timing of juvenile salmonids entering the reservoir, salmonid residence time, water temperature, and flow. The model predicted survival similar to independent estimates for 1983-1986 and also approximated differences among areas and months. Uncertainty analyses showed that the number of salmonids surviving predation may vary +/-5% with normal annual variation in predator number, temperature, and flow. Survival in 1983-1986 was near the average predicted from 30 years of historic environmental data. Sensitivity analyses implied that the best avenues of reducing predation are to reduce the number of northern squawfish, pass salmonids earlier in the year, and maintain sizes of runs of juvenile salmonids at or above present levels. Survival of salmonids, as simulated by the model, is weakly affected by changes in predator distribution, changes in predator consumption rate near the upstream dam, residence time, or flow. (Author's abstract)
W91-06028

CATCH-AND-RELEASE MANAGEMENT OF A TROUT STREAM CONTAMINATED WITH PCBS.
Connecticut Dept. of Environmental Protection, Harwinton. Inland Fisheries Div.
R. D. Orciari, and G. H. Leonard.
North American Journal of Fisheries Management NAJMDP, Vol. 10, No. 3, p 315-329, Summer 1990. 5 fig, 5 tab, 47 ref. Federal Aid in Fish Restoration Project F-57-R.

Descriptors: *Connecticut, *Fish management, *Polychlorinated biphenyls, *Sport fishing, *Trout, Fish populations, Fish stocking, Public health, Stream fisheries.

Due to health risks associated with PCB contamination, the Connecticut Department of Environmental Protection chose to apply catch-and-release regulations to the Housatonic River, which had previously supported one of the most popular put-and-take trout fisheries in Connecticut. The management change was successful in maintaining a highly rated recreational fishery. Stocked brown trout Salmo trutta survived up to five summers and grew to maximum total lengths of about 400 mm. Through 5 years, fish stocked as adults (254-305 mm) and yearlings (152-229 mm) had average annual survivals of 39 and 42%. Survival of fingerlings (<152 mm) averaged 22%. With holdover trout present after the first year of catch-and-release management, 50-66% of the fish caught by anglers exceeded the maximum length of 305 mm of trout stocked for put-and-take purposes in other Connecticut streams. Also, an average of 38%

more trout by number and 210% more trout by weight were caught and released than were stocked. The catch-and-release fishery supported continuous utilization and high catch rates throughout the fishing season. Anglers who kept diaries while fishing under catch-and-release management had significantly greater catch rates after May than did those fishing the same area under previous put-and-take conditions. These results suggest that catch-and-release management may be used to maintain popular, high-catch-rate trout fisheries in streams where contamination levels are a risk to human health but have no serious direct or indirect effects on fish. (Author's abstract)
W91-06030

TEMPERATURE PREFERENCE VERSUS ACCLIMATION IN FISHES: SELECTION FOR CHANGING METABOLIC OPTIMA.
Eastern New Mexico Univ., Portales. Dept. of Life Sciences.
For primary bibliographic entry see Field 2H.
W91-06036

YIELD OF YELLOW PERCH IN LAKES ERIE AND ST. CLAIR: COMMUNITY ASSOCIATIONS.
Ontario Ministry of Natural Resources, Maple. Fisheries Branch.
For primary bibliographic entry see Field 2H.
W91-06037

SUMMER HABITAT SUITABILITY FOR STRIPED BASS IN CHESAPEAKE BAY: REFLECTIONS ON A POPULATION DECLINE.
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2L.
W91-06038

SPECIES COMPOSITION, DISTRIBUTION, AND INVERTEBRATE PREY OF FISH ASSEMBLAGES IN THE COLUMBIA RIVER ESTUARY.
Oregon Dept. of Fish and Wildlife, Corvallis.
For primary bibliographic entry see Field 2L.
W91-06286

SLACKWATER HABITAT IN TORRENT-IMPACTED STREAMS.
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 2E.
W91-06636

CONSERVATION OF FISH HABITAT IN STREAMS BY THE METHOD OF LOW DAMS SERIES.
Toyama Prefectural Coll. of Technology, Kosugi (Japan).
G. Takahashi, and S. Higashi.
IN: Erosion and Sedimentation in the Pacific Rim. IAHS Publication No. 165. International Association of Hydrological Sciences, Washington, DC. 1987. p 409-410. 3 ref.

Descriptors: *Aquatic habitats, *Channel improvement, *Dam effects, *Fisheries, *Japan, *Mountain streams, *Streams, Bank erosion, Channel erosion, Conservation, Dam construction, Debris flow, Erosion, Flooding, Fluctuations, Meanders, Sedimentation.

Rugged mountainous terrain and deformed geological structure create a high potential for flooding, erosion, and deposition in Japan. Channel works combined with groundsills and revetments are usually constructed to straighten the channel course in fan and floodplain valley areas. As a result, the original complexity of water currents and microtopography of a stream bed is lost, disturbing the fish habitat. Two types of channel course fluctuations exist in flood-plain valleys: continuous shifting due to bank erosion or bar movement and abrupt fluctuations accompanied by deposition. Even a small amount of deposition can cause an abrupt and large-scale fluctuation of channel location. In flood-plain valleys, channel fluctuations occur in two basic ways: moderate meander development with frequent course fluctuations caused by deposition, or meandering with infrequent deposition-caused fluctuations. The control of debris flows and the location of the channel course are most important in torrent control works. By setting a series of dams in flood-plain or fan areas, the energy of debris flows decreases because the flow is divided into load and water, and the channel course is fixed on the whole. In addition, channel stabilization is accomplished by setting the dams at places with high potential for abrupt channel fluctuations. By using these techniques, the complexity of fish habitats is preserved. (See also W91-06570) (Brunone-PTT)
W91-06637

INSHORE FISH YIELD POTENTIAL OF LAKE KARIBA, ZIMBABWE.
Zimbabwe Univ., Harare. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W91-06745

10. SCIENTIFIC AND TECHNICAL INFORMATION

10F. Preparation Of Reviews

FOCUS ON TOXICOLOGICAL ASPECTS OF PESTICIDE CHEMICAL INTERACTION IN DRINKING WATER CONTAMINATION.
Milan Univ. (Italy). Ist. di Farmacologia e Farmacognosia.
For primary bibliographic entry see Field 5F.
W91-05995

TOXICITY TEST WITH ALGAE: A DISCUSSION ON THE BATCH METHOD.
National Swedish Environment Protection Board, Solna.
For primary bibliographic entry see Field 5A.
W91-06002

SUBJECT INDEX

3-METHYLCHOLANTHRENE
Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

ABERDEEN PROVING GROUND
Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

ABRASION
Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

ABSORPTION
Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

ACCELERATED EROSION
Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

ACETAMINOPHEN
Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

ACETONE
Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

ACETONITRILE
Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

ACETYLENIC ALCOHOLS
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

ACID LAKES
Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

ACID RAIN
Rain and Urban Stormwater Quality.
W91-06053 5B

Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Acid Rain.
W91-06236 5B

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Forest Hydrology and Watershed Management.
W91-06510 4C

Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

ACID RAIN EFFECTS
Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Acid Rain.
W91-06236 5B

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

ACID STREAMS

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

ACID TOLERANCE

Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

ACIDIC SOILS

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

ACIDIC WATER

Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

ACIDIFICATION

Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

ACIDITY

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

ACIDS

New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

ACOUSTICS

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

ACTIVATED CARBON

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Microbiology of Activated Carbon.
W91-06199 5F

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

ACTIVATED SLUDGE

Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

ACTIVATED SLUDGE PROCESS
Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

ACUTE TOXICITY
Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

ADIRONDACK MOUNTAINS
Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

ADSORBENTS
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

ADSORPTION
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

ADSORPTION-DESORPTION
Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

ADSORPTION KINETICS
Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

ADVANCED WASTEWATER TREATMENT
Water Hyacinth Growth in Anaerobic Digester Effluents.
W91-06222 5D

ADVECTION
Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

AERATED LAGOONS
Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

AERATION
Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

AERIAL PHOTOGRAPHY
Applications of Remote Sensing Techniques for the Inventory and Monitoring of Environmental Pollution.
W91-07052 7B

AEROBIC CONDITIONS
Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

AEROBIC TREATMENT
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

AEROSOLS
Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

AFRICA
Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

AGGREGATES
Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

AGRICULTURAL CHEMICALS
Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

AGRICULTURAL ENGINEERING
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

Nutrient Needs.
W91-06398 3F

Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

Reduce Greenhouse Runoff.
W91-06403 3F

Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

AGRICULTURAL HYDROLOGY
Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

AGRICULTURAL PRACTICES
Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

AGRICULTURAL PRACTICES

Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

Soil Erosion Studies in Peru.
W91-06277 4D

Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Estimation of N Budgets for Crops.
W91-06739 3F

Cropping Systems: Ecology and Management.
W91-06741 3F

Management of Water Balance Components.
W91-06742 3F

Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

AGRICULTURAL RUNOFF

Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

AGRICULTURAL WATER

Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

AGRICULTURE

Agriculture's Role in Protecting Water Quality.
W91-06305 5G

Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

Effect of Climate Change on Sea Level Rise and the Implications for World Agriculture.
W91-06416 5C

Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

AGRONOMY

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

AIR POLLUTION

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

Rain and Urban Stormwater Quality.
W91-06053 5B

Acid Rain.
W91-06236 5B

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

AIR POLLUTION EFFECTS

Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

AIR POLLUTION SOURCES

Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

AIR STRIPPING

Removing VOCs by Membrane Stripping.
W91-06814 5F

AIR-WATER INTERFACES

Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

ALACHLOR

Transformation of Alachlor by Microbial Communities.
W91-06829 7B

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

ALASKA

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

ALBERTA

Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

ALDER TREES

Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

ALDICARB

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

ALGAE

Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

ALGAL BLOOMS

Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

ALGAL GROWTH

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

ALGAL PHYSIOLOGY

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

ALGAL TOXINS

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

ALKALI METALS

Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

ALKALINE EARTH METALS

Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

ALKALINITY

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

ALLIGATORS

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

ALLUVIAL CHANNELS

Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

ALLUVIAL DEPOSITS

Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

ALTERNATIVE PLANNING

Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

ALUMINUM

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

ALUMINUM CHLORIDE

New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

AMAZON

Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

AMAZON RIVER BASIN

Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

AMINO ACIDS

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

AMMONIA

Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

Nutrient Needs.
W91-06398 3F

AMMONIA REMOVAL

Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

AMMONIFICATION
Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

AMMONIUM
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

AMPHIBIANS
Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

AMPHIPODS
Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

ANABAENA
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

ANADROMOUS FISH
Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

ANAEROBIC BACTERIA
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

ANAEROBIC CONDITIONS
Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

ANAEROBIC DIGESTION
Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

Psychrophilic Anaerobic Digestion of Animal Manure: Proposed Design Methodology.
W91-06225 5D

Surface Charge on Wastewater Sludges.
W91-06439 5D

Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

ANALYTICAL METHODS
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Determination of Soluble Selenium in Soils.
W91-06970 5A

Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

ANALYTICAL TECHNIQUES
Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

ANDES MOUNTAINS
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

ANIMAL BEHAVIOR
Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

ANIMAL DISEASES
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudo-

pleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

ANIMAL METABOLISM
Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

ANIMAL PATHOLOGY
Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

ANIMAL PHYSIOLOGY
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

ANIMAL TISSUES
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

ANIMAL WASTES
Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

Psychrophilic Anaerobic Digestion of Animal Manure: Proposed Design Methodology.
W91-06225 5D

Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

ANOXIC CONDITIONS
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

ANTAGONISTIC EFFECTS
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

ANTARCTICA
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

ANTECEDENT MOISTURE
Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

ANTHESIS
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

ANTIFOULANTS
Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

ANTIKYRA GULF
Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

APHANIZOMENON
Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

AQUATIC ANIMALS
Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

AQUATIC ANIMALS

Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

AQUATIC BACTERIA

Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

AQUATIC ENVIRONMENT

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

AQUATIC FUNGI

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

Laboratory Evaluation of Lagenidium giganteum (Oomycetes: Lagenidiales) in Water from Contra Costa County, California, Mosquito Sources.
W91-06122 5G

AQUATIC HABITATS

Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

AQUATIC INSECTS

Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

AQUATIC LIFE

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

AQUATIC PLANTS

Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

AQUATIC PRODUCTION

Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

AQUATIC PRODUCTIVITY

Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

AQUATIC SOILS

Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

AQUATIC VEGETATION

Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

AQUATIC WEED CONTROL

Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

AQUIFER RESTORATION

Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

AQUIFER SYSTEMS

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

AQUIFERS

Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

ARCHAEOLOGY

Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

ARID LANDS
Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

ARID REGIONS
Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

ARIZONA
William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

AROMATIC COMPOUNDS
Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

ARROYOS
Evolution of an Anthropogenic Desert Gully System.
W91-06721 2J

ARSENIC
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

ARSENIC COMPOUNDS
Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

ARTIFICIAL RECHARGE
Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

ARTIFICIAL REEFS
Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

ARTIFICIAL STREAMS
Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

ASH CREEK
Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

ASTERIONELLA
Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

ATLANTIC TOMCOD
Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

ATMOSPHERIC CHEMISTRY
Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

ATMOSPHERIC CIRCULATION
Mechanisms of the Black Sea Circulation.
W91-06410 2B

ATMOSPHERIC WATER
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

ATOMIC ABSORPTION SPECTROPHOTOMETRY
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

ATRAZINE
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

ATTERBERG LIMITS
Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

AUSTRALIA
Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

AUTOMATION
Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

AVAILABLE WATER
Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

AVALANCHES
Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

AVOIDANCE
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

BACILLUS
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

BACKWATER
Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

BACKWATER EFFECT
Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

BACTERIA
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

BACTERIAL ANALYSIS
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Waterborne Giardiasis.
W91-06207 5F

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Legionella in Drinking Water.
W91-06210 5A

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

BACTERIAL GROWTH
Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

BACTERIAL PHYSIOLOGY
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

BAHRAIN
Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

BALD EAGLES
Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

BANGLADESH
Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

BANKFULL STAGE
Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

BARIUM
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

BARN WASTEWATER
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

BARRIER ISLANDS
Groundwater Seepage along a Barrier Island.
W91-06954 2F

BASE FLOW
Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Optimal Spectral Base-Flow Estimation.
W91-07034 2E

BASELINE STUDIES
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

BATTERIES
Superfund Record of Decision: United Scrap Lead, OH.
W91-07051 5G

BAYS
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

BEANS
Effect of Pattern of Water Supply on Vicia faba L.: 1. Dry Matter Partitioning and Yield Variability.
W91-06932 3F

Effect of Pattern of Water Supply on Vicia Faba L.: 2. Pod Retention and Filling, and Dry Matter Partitioning, Production and Water Use.
W91-06934 3F

BED LOAD
Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

BED-LOAD DISCHARGE
Critical Conditions for Bed Material Movement in Steep, Boulder-Bed Streams.
W91-06618 2J

Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

BEDROCK
Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

BELGIUM
Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

BENTHIC FAUNA
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Environmental Contamination and Cancer in Fish.
W91-06378 5C

BENTHOS
Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

BENZOPYRENE
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

BETA-NAPHTHAFLAVONE
Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

BICARBONATES
HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

BILGE
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

BIOACCUMULATION
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

Hydrocarbon Bioaccumulation from Contaminated Sediment by the Deposit-Feeding Polychaete Abarenicola pacifica.
W91-06259 5B

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Sludge Metal Bioavailability.
W91-06448 5B

Sludge Organics Bioavailability.
W91-06449 5B

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

BIOASSAY
Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Sentinel Species and Sentinel Bioassay.
W91-06190 5A

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular

BIOASSAY

Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

BIOAVAILABILITY

Sludge Metal Bioavailability.
W91-06448 5B

Sludge Organics Bioavailability.
W91-06449 5B

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

BIOCHEMICAL OXYGEN DEMAND

Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

BIOCHEMISTRY

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

BIOCONTROL

Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

Laboratory Evaluation of Lagenidium giganteum (Oomycetes: Lagenidiales) in Water from Contra Costa County, California, Mosquito Sources.
W91-06122 5G

BIODEGRADATION

Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

Transformation of Alachlor by Microbial Communities.
W91-06829 7B

Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

BIOFILMS

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Biofilms in Potable Water Distribution Systems.
W91-06206 5F

Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

BIOGEOCHEMISTRY

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

BIOGRAPHIES

William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

BIOINDICATORS

Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Biomarkers of Environmental Contamination.
W91-06176 5A

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

Biological Monitoring: Testing for Genotoxicity.
W91-06183 5A

Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

Metallothionein: A Potential Biomonitor of Exposure to Environmental Toxins.
W91-06188 5A

Sentinel Species and Sentinel Bioassay.
W91-06190 5A

Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

Use of Biomarkers in Ecological Risk Assessment.
W91-06193 5A

Tropical Source Water.
W91-06196 5F

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

BIOLOGICAL FILTERS

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

BIOLOGICAL MAGNIFICATION

Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

BIOLOGICAL POLLUTION
Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

BIOLOGICAL STUDIES
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

BIOLOGICAL TREATMENT
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

BIOLOGICAL WASTEWATER TREATMENT
Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

BIOMAGNIFICATION
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

BIOMASS
Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

BIOREDUCTION
Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

BIOREMEDIATION
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

BIOTECHNOLOGY
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

BIOTRANSFORMATION
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

BIRDS
Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

BITUMEN
Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

BIVALVES
Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

BLACK FLIES
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

BLACK SEA
Mechanisms of the Black Sea Circulation.
W91-06410 2B

BLADDER CANCER
Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

BLOOD
Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

BOGS
Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

BOLIVIA
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

BOREHOLE GEOPHYSICS
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

BOREHOLES
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

BORON
Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

BOSTON HARBOR
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

BOTTLED WATER
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

BOULDER-BED STREAMS
Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Critical Conditions for Bed Material Movement in Steep, Boulder-Bed Streams.
W91-06618 2J

BOUNDARY ELEMENT METHOD
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

BOUNDARY PROCESSES
Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

BRAIDED STREAMS
Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

BRAZIL
Rain and Urban Stormwater Quality.
W91-06053 5B

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

BRINE DISPOSAL
Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

BRITISH COLUMBIA
Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

Influence of Large Organic Debris on Channel Recovery in the Queen Charlotte Islands, British Columbia, Canada.
W91-06621 4C

BROMACIL
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

BULKING SLUDGE
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

BUOYANCY
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

BUTYLATE
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

BUZZARDS BAY
Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

CADMIUM
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

CALCAREOUS SOILS
Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

CALCITE
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

CALCIUM
Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

CALCIUM CARBONATE
Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

CALIFORNIA
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

CALIFORNIA

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

CANADA

Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

Water Resource Planning in Canada.
W91-06230 6E

Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

Time-Lapse Streamflow over North America.
W91-06509 2E

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

CANAL DESIGN

Vortex-Settling Basin Design Considerations.
W91-06292 8B

CANALS

Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

CANCER

Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

CANOPY

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

CAPE COD

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

CARBAMATE PESTICIDES

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

CARBAMATES

Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

CARBAMOTHIOATE HERBICIDES

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

CARBARYL

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

CARBON

HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

CARBON FILTERS

Microbiology of Activated Carbon.
W91-06199 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

CARBON RADIOISOTOPES

Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

CARBON RIVER

Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

CARBON TETRACHLORIDE

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

CARCINOGENICITY

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the

Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Chlorination of Drinking Water and Cancer.
W91-06898 5F

CARCINOGENS

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

CARP

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

CASAMANCE RIVER

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

CASE STUDIES

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

CATALYSIS

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

CATALYSTS

Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

CATCHMENT AREAS

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

CATFISH

Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

CELL COUNTING

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

CELL CULTURE

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

CELL INJURY

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

CEMENT DUST

Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

CEMENTS

Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

CENTRIFUGATION

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

CERIODAPHNIA

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

CERIUM

Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

CESIUM RADIOISOTOPES

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

CHANGJIANG RIVER

Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

CHANNEL EROSION

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

CHANNEL FLOW
Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

CHANNEL IMPROVEMENT
Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

CHANNEL MORPHOLOGY
Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

Influence of Large Organic Debris on Channel Recovery in the Queen Charlotte Islands, British Columbia, Canada.
W91-06621 4C

Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

CHANNEL SCOUR
Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

CHANNEL STORAGE
Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

CHANNELING
Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

CHANNELS
Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

CHELATING AGENTS
Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

CHELATION
Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

CHEMICAL ANALYSIS
Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

CHEMICAL COAGULATION
Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

CHEMICAL DEGRADATION
Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

CHEMICAL INDUSTRY
Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

CHEMICAL INTERACTIONS
Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

CHEMICAL PRECIPITATION
Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

CHEMICAL PROPERTIES
Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

CHEMICAL REACTIONS
Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

CHEMICAL SPECIATION
Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

CHEMICAL TREATMENT
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

CHEMICAL WASTES
Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

CHEMISTRY OF PRECIPITATION
Rain and Urban Stormwater Quality.
W91-06053 5B

Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

CHERNOBYL ACCIDENT
Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

CHESAPEAKE BAY
Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

CHILE
High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

CHINA
Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

Study of the Total Load Transport by the Yellow River.
W91-07108 2J

CHLAMYDOMONAS
Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

CHLORELLA
Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

CHLORIDES
Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

CHLORIMURON
Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

CHLORINATED AROMATIC COMPOUNDS
Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

CHLORINATED HYDROCARBON INSECTICIDES
Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

CHLORINATED HYDROCARBONS
Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

Sludge Organics Bioavailability.
W91-06449 5B

CHLORINATED HYDROCARBONS

Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

CHLORINATION

Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Chlorination of Drinking Water and Cancer.
W91-06898 5F

Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

CHLORINE

Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

CHLOROPHENOLS

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

CHLOROPHYLL A

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

CHLOROPHYTA

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

CHROMATES

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

CHROMIUM

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

CHRONIC TOXICITY

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

CITRIC ACID

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

CLADOPHORA

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

CLAMS

Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

CLARIFICATION

Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

CLAY SOILS

Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Shrinkage of Dutch Clay Soil Aggregates.
W91-06935 2G

CLAYS

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

CLEANING

Source Reduction--Parts Cleaning.
W91-06682 5E

CLEANING WASTES

Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

CLEANUP

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

National Response Team: A Report on the National Oil and Hazardous Substances Response System.
W91-07036 5G

CLEANUP OPERATIONS

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

Superfund Record of Decision: United Scrap Lead, OH.
W91-07051 5G

Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

CLEANUP PROCEDURES
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

CLEAR-CUTTING
Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

CLIMATES
Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

CLIMATIC CHANGES
Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

Effect of Climate Change on Sea Level Rise and the Implications for World Agriculture.
W91-06416 5C

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

CLIMATIC DATA
Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

CLIMATOLOGY
Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

CLOUD CHEMISTRY
Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

CLOUD LIQUID WATER
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

CLOUDWATER COLLECTORS
Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

COAGULATION
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

COAL MINE WASTES
Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

COASTAL ENVIRONMENT
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

COASTAL PLAINS
Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

COASTAL STREAMS
Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

COASTAL WATERS
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

COASTAL ZONE MANAGEMENT
Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

COASTS
Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

COATINGS
Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

COBALT
Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

COELENTERATES
Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

COHESIONLESS SOILS
Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

COLIFORMS
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

COLLOIDS
Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

COLLUVIAL SOILS
Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

COLOMBIA
Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

COLONIZATION
Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

COLORADO
Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

COLORADO RIVER
Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

COLUMBIA RIVER
Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

COLUMBIA RIVER ESTUARY
Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

COMMERCIAL FISHING
Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

COMPARISON STUDIES
Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

COMPOSTING
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

COMPUTER MODELING
Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

COMPUTER MODELS
Network Management--the Bradford Experience.
W91-05967 5F

Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

Computation (Investigation, Education, and Application).
W91-07027 8B

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

COMPUTER PROGRAMS
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

CONDUCTANCE
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

CONDUCTIVITY
Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

CONFERENCES
FRIENDS in Hydrology.
W91-06461 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

CONGO RIVER
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

CONGO RIVER BASIN
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

CONIFEROUS FORESTS
Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

CONIFERS
Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

CONNECTICUT
Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

CONSERVATION
Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

CONSTRUCTION MATERIALS
Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

CONTAMINATION
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Environmental Contamination and Cancer in Fish.
W91-06378 5C

CONVECTION
Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

COPPER
Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

COPPER COMPOUNDS
Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

COPPER RIVER DELTA
Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

COPPER SULFATE
Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

CORMORANTS
Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

CORN
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

CORRELATION ANALYSIS
Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

COST ALLOCATION
Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

Minimizing Waste by Charging the Generator.
W91-06161 5E

Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

COST ANALYSIS
Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

COST-BENEFIT ANALYSIS
Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

Economics of Nitrate Pollution.
W91-06790 5C

COST REPAYMENT
Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

COST SHARING
Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

COTTON
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

CRABS
Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

CRAYFISH
Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

CREEP
Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

CREOSOTE
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

CROAKERS
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

CROP PRODUCTION
Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

CROP YIELD
Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

Effect of Pattern of Water Supply on Vicia faba L.: 1. Dry Matter Partitioning and Yield Variability.
W91-06932 3F

Effect of Pattern of Water Supply on Vicia Faba L.: 2. Pod Retention and Filling, and Dry Matter Partitioning, Production and Water Use.
W91-06934 3F

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

CROPLAND
Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

Sediment Losses from Cropland Furrows.
W91-07058 2J

CROPPING
Proper Accounting for N in Cropping Systems.
W91-06737 3F

Cropping Systems: Ecology and Management.
W91-06741 3F

Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

CROPS
Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

CRUSTACEANS
Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

CRYPTOSPORIDIUM
Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

CULTIVATED LANDS
Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

CULTURE MEDIA
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

CULTURING TECHNIQUES
Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

Waterborne Giardiasis.
W91-06207 5F

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

CUMBERLAND RIVER
Current Distribution and Status of the Upper Cumberland River Johnny Darter, Etheostoma nigrum susanae.
W91-06019 2H

CYANOPHYTA
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

CYCLING NUTRIENTS
Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

CYTOCHROMES
Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

CYTOLOGY
Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

CZECHOSLOVAKIA
Management of Forests with Water Conservation Function.
W91-06554 4A

DAM EFFECTS
Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

Mathematical Model for Reservoir Silting.
W91-07062 2J

Silting of Moroccan Dams.
W91-07065 2J

DAM INSPECTION
Dam Safety Inspection Scheduling.
W91-06295 8G

DAM SAFETY
Dam Safety Inspection Scheduling.
W91-06295 8G

DAMAGE
Flow in Damaged Pipe Networks.
W91-06296 8A

DAMAGED PIPE NETWORKS
Flow in Damaged Pipe Networks.
W91-06296 8A

DAMS
Dam Safety Inspection Scheduling.
W91-06295 8G

Silting of Moroccan Dams.
W91-07065 2J

DAPHNIA
Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

DARTERS
Current Distribution and Status of the Upper Cumberland River Johnny Darter, Etheostoma nigrum susanae.
W91-06019 2H

DATA ACQUISITION
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analy-

sis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

DATA ANALYSIS
FRIENDS in Hydrology.
W91-06461 2E

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Flood-Calculations in Norway.
W91-06502 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Low Flow Analysis.
W91-06505 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Time-Lapse Streamflow over North America.
W91-06509 2E

DATA COLLECTIONS
Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

DATA INTERPRETATION
Historical Changes in the Columbia River Estuary.
W91-06288 2L

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

DATA PROCESSING
Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Computation (Investigation, Education, and Application).
W91-07027 8B

DATA QUALITY
Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

DATA QUALITY CONTROL
Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

DATING
Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

DDE
Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's

Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

DDT
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

DEBRIS FLOW
Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

Sediment Routing by Debris Flow.
W91-06594 2J

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

Erosion Processes and Effects of Debris Flow.
W91-06596 2J

Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

DEBRIS REMOVAL
Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

DECHLORINATION
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

DECIDUOUS TREES
Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

DECISION MAKING
Multicriterion Forest Watershed Resources Management.
W91-06569 6A

DECOMPOSITION
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

DECONTAMINATION
Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

DEFORESTATION
Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

DEGRADATION
Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

DEGRADATION PRODUCTS
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

DELTAMETHRIN
Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

DELTAS
Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

DEMETALLATION
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

DENITRIFICATION
Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

DENMARK
Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

DEOXYRIBONUCLEIC ACID
Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

DEPOSITION
Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

Erosion, Transport and Deposition Processes.
W91-06717 2J

DEPRESSION STORAGE
Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

DESALINATION
Desalting Practices in the United States.
W91-06808 3A

Use of Membrane Technology in Florida.
W91-06809 3A

DESALINATION APPARATUS
Desalting Practices in the United States.
W91-06808 3A

Use of Membrane Technology in Florida.
W91-06809 3A

DESALINATION PLANTS
Desalting Practices in the United States.
W91-06808 3A

Use of Membrane Technology in Florida.
W91-06809 3A

DESERT PLANTS
William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

DESERTS
Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

Evolution of an Anthropogenic Desert Gully System.
W91-06721 2J

Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

DESIGN FLOW
First-Order Analysis of Open-Channel Flow.
W91-06297 8B

DESORPTION
Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

DETERGENTS
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

DETOXIFICATION
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

DETRITUS
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

Influence of Large Organic Debris on Channel Recovery in the Queen Charlotte Islands, British Columbia, Canada.
W91-06621 4C

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

DEVELOPING COUNTRIES
Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Water Quality and Health.
W91-06060 5C

Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

Water Quality and Health (Review of the International Drinking Water Supply and Sanitation Decade).
W91-06064 5F

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

Domestic Water Treatment for Developing Countries.
W91-06202 5F

Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

DEVILS LAKE
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

DEW
Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

DEWATERING
Solid/Liquid Separation: Waste Management and Productivity Enhancement.
W91-06421 5D

Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

DEWATERING

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

DIALYSIS
Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

DIATOMACEOUS EARTH
Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

DIATOMS
Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

DIBENZOXAZEPINE
Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

DICHLOROMETHANE
Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

DICHLOROPHENOL
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

DIETHYLNITROSAMINE
Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

DIETS
Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

DIFFUSERS
Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

DIFLUBENZURON
Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

DIGESTIVE GLAND
Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

DINOFLAGELLATES
Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

DIOXINS
Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

DIPHENAMID
Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

DISASTERS
Erosion Research and Control in Japan.
W91-06572 4D

Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

DISCHARGE FORECASTING
First-Order Analysis of Open-Channel Flow.
W91-06297 8B

DISINFECTION
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

Performance and Analysis of Tracer Tests to Determine Compliance of a Disinfection Scheme with the SWTR.
W91-05965 5F

Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

Domestic Water Treatment for Developing Countries.
W91-06202 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Biofilms in Potable Water Distribution Systems.
W91-06206 5F

Chlorination of Drinking Water and Cancer.
W91-06898 5F

DISPERSION
Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

DISPOSAL WELLS
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

DISSOLVED LOAD
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

DISSOLVED ORGANIC CARBON
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

Dissolved Organic Carbon in Forested and Cut-over Drainage Basins, Westland, New Zealand.
W91-06555 4A

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

DISSOLVED OXYGEN
Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

DISSOLVED SOLIDS
Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

DIURNAL VARIATION
Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

DNA
DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

DOMESTIC WASTES
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

Ten-Minute Digestion.
W91-06429 5D

Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

DOMESTIC WATER
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

Domestic Water Treatment for Developing Countries.
W91-06202 5F

Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

DOSE-RESPONSE RELATIONSHIPS
Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

DRAINAGE AREA
Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

DRAINAGE DENSITY
Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

DRAINAGE EFFECTS
Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Dissolved Organic Carbon in Forested and Cut-over Drainage Basins, Westland, New Zealand.
W91-06555 4A

Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

DRAINAGE PATTERNS
Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

DRAINAGE PRACTICES
Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

DRAINAGE SYSTEMS
Towards a Dynamic Model of Gully Growth.
W91-06725 2J

DREDGE SPOIL
Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

DREDGING WASTES
Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

DRINKING WATER
Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

Performance and Analysis of Tracer Tests to Determine Compliance of a Disinfection Scheme with the SWTR.
W91-05965 5F

Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

Chemical Aspects of Water Quality and Health.
W91-05976 5F

Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

Microbiology of Activated Carbon.
W91-06199 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Domestic Water Treatment for Developing Countries.
W91-06202 5F

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Legionella in Drinking Water.
W91-06210 5A

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Viruses in Source and Drinking Water.
W91-06212 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

DRINKING WATER

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

Removing VOCs by Membrane Stripping.
W91-06814 5F

Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

Chlorination of Drinking Water and Cancer.
W91-06898 5F

Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

DRINKING WATER POLLUTION

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

DRINKING WATER SOURCES

Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

DROUGHT

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

DROUGHT EFFECTS

Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

DROUGHT RESISTANCE

Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

DRY CREEK

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

DRY MATTER

Effect of Pattern of Water Supply on Vicia Faba L.: 2. Pod Retention and Filling, and Dry Matter Partitioning, Production and Water Use.
W91-06934 3F

EARTHQUAKES

Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

EAST ROSEBUD RIVER

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

ECHINODERMS

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

ECOLOGICAL DISTRIBUTION

Ecological Studies on the Hydromedusae, Siphonophores and Ctenophores in the Xiamen Harbor and Adjacent Waters.
W91-06106 2L

Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

ECOLOGICAL EFFECTS

Use of Biomarkers in Ecological Risk Assessment.
W91-06193 5A

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

ECOLOGY

William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

ECONOMIC ASPECTS

Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

ECONOMIC EVALUATION

Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

Economics of Nitrate Pollution.
W91-06790 5C

Economic Value of Wetlands-Based Recreation.
W91-06831 6B

ECOSYSTEMS

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

ECOTOXICOLOGY

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

ECUADOR
Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

EDDY DIFFUSION
Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

EFFLUENTS
Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

EGGS
Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

EGYPT
Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

EL NINO
El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

ELECTRIC POWER INDUSTRY
Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

ELECTRIC POWERPLANTS
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

ELECTRO-OSMOSIS
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

ELECTROACOUSTIC TECHNIQUES
Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

ELECTROCHEMISTRY
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

ELECTROCOAGULATION
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

ELECTRODIALYSIS
Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

Use of Membrane Technology in Florida.
W91-06809 3A

ELECTROOLFACTOGRAMS
Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

ELECTROPHORESIS
Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

ELIMINATION
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

EMBRYONIC GROWTH STAGE
Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

EMISSION SPECTROMETRY
Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

EMISSION SPECTROSCOPY
Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

ENDOSULFAN
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

ENDRIN
Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

ENERGY
Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

ENERGY SOURCES
Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

ENERGY TRANSFER
Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

ENGLAND
Isle of Wight Water Metering Trial.
W91-05966 3F

Network Management--the Bradford Experience.
W91-05967 5F

Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

River Basin Management in the UK.
W91-06045 6E

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

ENGLAND

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

ENGLISH CHANNEL
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

ENRICHMENT
Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

ENTERIC BACTERIA
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

ENTEROVIRUSES
Viruses in Source and Drinking Water.
W91-06212 5F

ENVIRONMENTAL CHEMISTRY
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

ENVIRONMENTAL EFFECTS
Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

ENVIRONMENTAL ENGINEERING
Project Management.
W91-06848 6A

ENVIRONMENTAL GRADIENT
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

ENVIRONMENTAL IMPACT
Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

ENVIRONMENTAL MANAGEMENT
Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

ENVIRONMENTAL MONITORING
Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

Observations on Fish Community Health.
W91-06930 5A

ENVIRONMENTAL POLICY
Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

Land and Liquid Disposal Bans.
W91-06679 5E

Economics of Nitrate Pollution.
W91-06790 5C

New Strategies for Great Lakes Toxicology.
W91-06926 5A

Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

Observations on Fish Community Health.
W91-06930 5A

ENVIRONMENTAL PROTECTION
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

Biomarkers of Environmental Contamination.
W91-06176 5A

Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

ENVIRONMENTAL QUALITY
Agriculture's Role in Protecting Water Quality.
W91-06305 5G

ENVIRONMENTAL SANITATION
Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

ENZYME IMMUNOASSAY
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

ENZYMES
Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

EPHEMERAL STREAMS

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

EPIDEMIOLOGY

Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

ERODIBILITY

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

EROSION

Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

Indoor Soil Erosion Research Facility.
W91-06232 2J

Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

Erosion and Sedimentation in the Pacific Rim.
W91-06570 2J

Erosion and Sedimentation Issues in Peru.
W91-06571 2J

Erosion Research and Control in Japan.
W91-06572 4D

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

Sediment Routing by Debris Flow.
W91-06594 2J

Erosion Processes and Effects of Debris Flow.
W91-06596 2J

Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

Hydromechanical Erosion Model for Surface-Mined Areas.
W91-06599 4C

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

Erosional Effects of Road Construction in Pi-Lu Experimental Watershed.
W91-06608 2J

Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

EROSION

Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Erosion, Transport and Deposition Processes.
W91-06717 2J

Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

Towards a Dynamic Model of Gully Growth.
W91-06725 2J

Dynamics of Gully Head Recession in a Savanna Environment.
W91-06726 2J

Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

EROSION CONTROL

Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

Soil Erosion Studies in Peru.
W91-06277 4D

Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

Erosion and Sedimentation Issues in Peru.
W91-06571 2J

Erosion Research and Control in Japan.
W91-06572 4D

Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

EROSION RATES

Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

Indoor Soil Erosion Research Facility.
W91-06232 2J

Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

ERROR ANALYSIS

Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

ESCHERICHIA COLI

Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

ESTUARIES

Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Economic Value of Wetlands-Based Recreation.
W91-06831 6B

Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

Sea Level Variability in Long Island Sound.
W91-06833 2L

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

Great Lakes Estuaries.
W91-06846 2H

Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

ESTUARINE ENVIRONMENT

Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

ESTUARINE FISHERIES

Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

ESTUARINE SEDIMENTS

Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

ETHANOL
Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

ETHOXY-RESORUFIN O-DEETHYLASE
Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

ETHYLENETHIOUREA
Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

EUCALYPTUS TREES
Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

EUROPE
Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

EUTROPHIC LAKES
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

EUTROPHICATION
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

EVALUATION
Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

EVAPORATION
Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

EVAPORATION RATE
Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

EVAPOTRANSPIRATION
Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

EVAPOTRANSPIRATION POTENTIAL
Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

EXCRETION
Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

EXPERIMENTAL BASINS
FRIENDS in Hydrology.
W91-06461 2E

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

EXPERIMENTAL DESIGN

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

FALLOUT

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

FARM MANAGEMENT

Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

Agriculture's Role in Protecting Water Quality.
W91-06305 5G

Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

FARM WASTES

Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

FATE OF POLLUTANTS

Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

Transformation of Alachlor by Microbial Communities.
W91-06829 7B

Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

FATHEAD MINNOWS

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

FATHEAD MINNOWS

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

FEED MATERIALS PRODUCTION CENTER
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

FENAMIPHOS
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

FERRITE PROCESS
Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

FERTILIZATION
Nutrient Needs.
W91-06398 3F

Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

FERTILIZERS
Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

Fertilizer Nitrogen Management.
W91-06738 3F

FIBERGLASS
Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

FIELD TESTS
Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

FILTER MEDIA
Thin Cake Filtration: Theory and Practice.
W91-06425 5D

Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

FILTRATION
Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

Microbiology of Activated Carbon.
W91-06199 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

Solid/Liquid Separation: Waste Management and Productivity Enhancement.
W91-06421 5D

Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

Thin Cake Filtration: Theory and Practice.
W91-06425 5D

Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

Use of Membrane Technology in Florida.
W91-06809 3A

Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

FINANCING
Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

FINITE DIFFERENCE METHODS
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

FINLAND
Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

FIRE EFFECTS
Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

FISH
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Review of Biochemical Methods and Other Indicators to Assess Fish Health in Aquatic Ecosystems Containing Toxic Chemicals.
W91-06920 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

FISH BEHAVIOR

Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

FISH DIETS

Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

FISH DISEASES

Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

FISH EGGS

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

FISH FOOD ORGANISMS

Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

FISH GROWTH

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

FISH HARVEST

Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

FISH LARVAE

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

FISH MANAGEMENT

Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

New Strategies for Great Lakes Toxicology.
W91-06926 5A

Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

Observations on Fish Community Health.
W91-06930 5A

Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

FISH MIGRATION

Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

FISH PATHOLOGY

Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

FISH PHYSIOLOGY

Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

FISH POPULATIONS

Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

Current Distribution and Status of the Upper Cumberland River Johnny Darter, Etheostoma nigrum susanae.
W91-06019 2H

Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

FISHERIES

Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

FISHERIES MANAGEMENT

Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

FJORDS

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

FLAGELLATES

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

FLATFISH

Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

FLIES

Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

FLOCCULATION

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

FLOOD CONTROL

Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

FLOOD DISCHARGE
Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

FLOOD FORECASTING
Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Flood-Calculations in Norway.
W91-06502 2E

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

FLOOD FREQUENCY
Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Flood-Calculations in Norway.
W91-06502 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

FLOOD PEAK
Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Flood-Calculations in Norway.
W91-06502 2E

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

FLOOD PLAIN MANAGEMENT
River Catchment Planning for Land Drainage, Flood Defence and the Environment.
W91-05971 4A

FLOOD PLAINS
Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

FLOODING
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

FLOODS
Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Flood-Calculations in Norway.
W91-06502 2E

FLORIDA
Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

Use of Membrane Technology in Florida.
W91-06809 3A

Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

FLORIDA KEYS
Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

FLOTATION
Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

FLOUNDERS
Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

FLOW CYTOMETRY
Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

FLOW DURATION
Regional Analysis of Flow Duration Curves.
W91-06484 2E

FLOW EQUATIONS
First-Order Analysis of Open-Channel Flow.
W91-06297 8B

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

FLOW MODELS
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

FLOW PATTERN
Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

FLOW PROFILES
Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

FLOW RATES
Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

FLOW RESISTANCE
Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

FLOW VELOCITY
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

FLUAZIFOP
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

FLUID MECHANICS
Drownproofing of Low Overflow Structures.
W91-06294 8B

FLUIDIZATION
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

FLUMES
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

FLUORESCENCE
Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

FLUORIDATION
Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

FLUORIDES
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

FLUOROMETRY
Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

FLUOROSIS
Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

FLUROXYPYR
Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

FLUVIAL SEDIMENTS
Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

FLY ASH
Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

FOOD CHAINS
Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

FOOD-PROCESSING WASTES
Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

FOODS
Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

FORAGES
Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

FOREST ECOSYSTEMS
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

FOREST FIRES
Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

FOREST HYDROLOGY
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

Forest Hydrology and Watershed Management.
W91-06510 4C

Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Management of Forests with Water Conservation Function.
W91-06554 4A

Dissolved Organic Carbon in Forested and Cutover Drainage Basins, Westland, New Zealand.
W91-06555 4A

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

Multicriterion Forest Watershed Resources Management.
W91-06569 6A

FOREST MANAGEMENT

Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Management of Forests with Water Conservation Function.
W91-06554 4A

Dissolved Organic Carbon in Forested and Cutover Drainage Basins, Westland, New Zealand.
W91-06555 4A

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

FOREST RECOVERY

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

FOREST SOILS

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

FOREST WATERSHEDS
Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Forest Hydrology and Watershed Management.
W91-06510 4C

From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Management of Forests with Water Conservation Function.
W91-06554 4A

Dissolved Organic Carbon in Forested and Cut-over Drainage Basins, Westland, New Zealand.
W91-06555 4A

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Multicriterion Forest Watershed Resources Management.
W91-06569 6A

Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

FORESTRY
Erosion and Sedimentation Issues in Peru.
W91-06571 2J

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

FORESTS
Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

FOULING
Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

FRANCE
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

FREEZE-THAW TESTS
Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

FREND PROJECT
FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

FREQUENCY DISTRIBUTION
Frequency Analysis of Flood and Low Flow.
W91-06504 2E

FRESHWATER MUSSELS
Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

FROGS
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

FROZEN GROUND
Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

FUEL
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

FUNGICIDES
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

FURROW DRAINAGE
Sediment Losses from Cropland Furrows.
W91-07058 2J

GARLON
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

GAS CHROMATOGRAPHY
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

GAS LIQUID CHROMATOGRAPHY
Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

GASES
Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

GASTROPODS
Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

GENETIC POLLUTION
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

GENETICS
Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

GENOTOXICITY
Biological Monitoring: Testing for Genotoxicity.
W91-06183 5A

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

GEOCHEMISTRY
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

GEOGRAPHIC INFORMATION SYSTEMS
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

GEOHYDROLOGY
Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

GEOHYDROLOGY

Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

GEOLOGIC EROSION

Model of River Basin Evolution.
W91-07026 2J

GEOLOGIC FORMATIONS

Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

GEOLOGIC HISTORY

Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

Model of River Basin Evolution.
W91-07026 2J

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

GEOLOGICAL DATA

MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

GEOMORPHOLOGY

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

Sediment Routing by Debris Flow.
W91-06594 2J

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

Relationship Between Sediment Delivery Ratio and Stream Order: a Romanian Case Study.
W91-06722 2J

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

Model of River Basin Evolution.
W91-07026 2J

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

GEORGIA

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

GEOSTATISTICS

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

GERMANY

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

GIARDIA

Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

Water Treatment for Health Hazards.
W91-05977 5F

GIARDIASIS

Waterborne Giardiasis.
W91-06207 5F

GIBBERELLIC ACID

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

GILLS

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

GLACIAL SEDIMENTS

Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

GLACIAL STREAMS

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

GLACIER MASS BALANCE
Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

GLACIOHYDROLOGY
Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

GLOBAL WARMING
Effect of Climate Change on Sea Level Rise and the Implications for World Agriculture.
W91-06416 5C

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

GLUCOSE
Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

GLUTATHIONE S-TRANSFERASES
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

GLYPHOSATE
Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

GOVERNMENT SUPPORTS
Agriculture's Role in Protecting Water Quality.
W91-06305 5G

GRAIN CROPS
Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

GRAND CANYON NATIONAL PARK
Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

GRANULAR ACTIVATED CARBON
Microbiology of Activated Carbon.
W91-06199 5F

GRASSES
Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

GRASSLANDS
Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

GRAVEL
Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

GRAVEL MINING
Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

GRAYLING
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

GRAZING
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

GREAT BRITAIN
Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

GREAT LAKES
Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

Great Lakes Estuaries.
W91-06846 2H

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

New Strategies for Great Lakes Toxicology.
W91-06926 5A

Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

Observations on Fish Community Health.
W91-06930 5A

Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

GREEN GLAND
Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

GREEN RIVER
Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

GREENHOUSE EFFECT
Effect of Climate Change on Sea Level Rise and the Implications for World Agriculture.
W91-06416 5C

GREENHOUSES
Reduce Greenhouse Runoff.
W91-06403 3F

GREENLAND
Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

GRENADA
Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

GROUND PENETRATING RADAR
Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

GROUNDWATER AVAILABILITY
Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

GROUNDWATER CHEMISTRY
Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

GROUNDWATER EXTRACTION
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

GROUNDWATER IRRIGATION
Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

GROUNDWATER MANAGEMENT
Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

GROUNDWATER MOVEMENT
Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

Linkages with Ground Water.
W91-06743 2F

Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

Groundwater Seepage along a Barrier Island.
W91-06954 2F

Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

GROUNDWATER POLLUTION
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Sources of Nitrate to Ground Water.
W91-06733 5B

Nitrate in Ground Water in the United States.
W91-06734 5B

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

Proper Accounting for N in Cropping Systems.
W91-06737 3F

Fertilizer Nitrogen Management.
W91-06738 3F

Estimation of N Budgets for Crops.
W91-06739 3F

Cropping Systems: Ecology and Management.
W91-06741 3F

Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

GROUNDWATER QUALITY
Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

Agriculture's Role in Protecting Water Quality.
W91-06305 5G

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

GROUNDWATER RESOURCES
Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

GROUTING
Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

GROWTH
Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

GROWTH STAGES
Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

GRUNTS
Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

GULF OF MEXICO
Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

GULLIES
Towards a Dynamic Model of Gully Growth.
W91-06725 2J

GULLS
Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

GULLY EROSION
Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

Evolution of an Anthropogenic Desert Gully System.
W91-06721 2J

Towards a Dynamic Model of Gully Growth.
W91-06725 2J

Dynamics of Gully Head Recession in a Savanna Environment.
W91-06726 2J

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

GYPSUM
Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

HALIDES
Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

HALOGENATED COMPOUNDS
Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

HALOGENATED HYDROCARBONS
Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

HALOGENATED PESTICIDES
Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

HANFORD
Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

HARBORS
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

HARDNESS
Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

HAWAII
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

HAZARD ASSESSMENT
Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

HAZARDOUS MATERIALS
Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

Making the Most of Bottoms and Residuals.
W91-06688 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

HAZARDOUS WASTE DISPOSAL
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Solvent Waste Reduction.
W91-06678 5D

Land and Liquid Disposal Bans.
W91-06679 5E

Waste Minimization Liability Issues.
W91-06680 5G

Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

Source Reduction--Parts Cleaning.
W91-06682 5E

Making the Most of Bottoms and Residuals.
W91-06688 5D

Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

HAZARDOUS WASTE TREATMENT
Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

HAZARDOUS WASTES
Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes.
W91-06124 5E

Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Minimizing Waste Oil Disposal.
W91-06168 5E

Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

Solvent Waste Reduction.
W91-06678 5D

Land and Liquid Disposal Bans.
W91-06679 5E

Waste Minimization Liability Issues.
W91-06680 5G

Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

Source Reduction--Parts Cleaning.
W91-06682 5E

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

National Response Team: A Report on the National Oil and Hazardous Substances Response System.
W91-07036 5G

Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

Environmental Risk Assessment/Environmental Hazard Assessment: Similarities and Differences.
W91-06692 5C

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Ten-Minute Digestion.
W91-06429 5D

Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Sludge Metal Bioavailability.
W91-06448 5B

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

HEMOLYMPH

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

HEPATOPANCREAS

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

HEPTACHLOR

Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

HERBICIDES

Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

Transformation of Alachlor by Microbial Communities.
W91-06829 7B

Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

HETEROGENEITY

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

HETEROTROPHIC BACTERIA

Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

HEXAZINONE

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

HIMALAYAN MOUNTAINS

Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

HISTOLOGY

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

HOGS

Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

HOLLOWS

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

HONG KONG

Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

HORTICULTURE

Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

Water Use and Average Growth Index of Five Species of Container Grown Woody Landscape Plants.
W91-06420 3F

Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

HOT AIR EXTRACTION
In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

HOWE SOUND
Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

HUANG HE RIVER BASIN
Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

Study of the Total Load Transport by the Yellow River.
W91-07108 2J

HUDSON RIVER
Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

HUMAN DISEASES
Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

HUMAN PATHOGENS
Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Tropical Source Water.
W91-06196 5F

Waterborne Giardiasis.
W91-06207 5F

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Legionella in Drinking Water.
W91-06210 5A

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

HUMAN PHYSIOLOGY
Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

HUMID CLIMATES
USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

HVALER ARCHIPELAGO
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

HYDRAULIC CONDUCTIVITY
Effect of the Composition of Soil Solutions and Exchange Cations on Water Retention and Hydraulic Conductivity.
W91-05980 2G

HYDRAULIC DESIGN
Vortex-Settling Basin Design Considerations.
W91-06292 8B

Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

HYDRAULIC ENGINEERING
Vortex-Settling Basin Design Considerations.
W91-06292 8B

Drownproofing of Low Overflow Structures.
W91-06294 8B

Dam Safety Inspection Scheduling.
W91-06295 8G

Flow in Damaged Pipe Networks.
W91-06296 8A

Computation (Investigation, Education, and Application).
W91-07027 8B

HYDRAULIC GEOMETRY
Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

HYDRAULIC GRADIENT
Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

HYDRAULIC JUMP
Drownproofing of Low Overflow Structures.
W91-06294 8B

HYDRAULIC MODELS
Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

HYDRAULIC PROPERTIES
Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

HYDRAULIC ROUGHNESS
Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

HYDRAULIC STRUCTURES
Drownproofing of Low Overflow Structures.
W91-06294 8B

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

HYDROCARBONS
Hydrocarbon Bioaccumulation from Contaminated Sediment by the Deposit-Feeding Polychaete Abarenicola pacifica.
W91-06259 5B

Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

HYDRODYNAMICS
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

Surging in Urban Storm Drainage Systems.
W91-07033 5D

HYDROELECTRIC PLANTS
Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

HYDROGEN ION CONCENTRATION
Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

HYDROGEN PEROXIDE
Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

HYDROGEN SULFIDE
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

HYDROGEOLOGY
Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

HYDROGRAPH ANALYSIS
Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

HYDROGRAPHS
Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

HYDROLOGIC BUDGET
Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

Management of Water Balance Components.
W91-06742 3F

HYDROLOGIC CYCLE
Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

HYDROLOGIC DATA
FRIENDS in Hydrology.
W91-06461 2E

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Flood-Calculations in Norway.
W91-06502 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Low Flow Analysis.
W91-06505 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Time-Lapse Streamflow over North America.
W91-06509 2E

HYDROLOGIC DATA COLLECTIONS

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

HYDROLOGIC MAPS

ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

HYDROLOGIC MODELS

Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

Mechanisms of the Black Sea Circulation.
W91-06410 2B

Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

Computation (Investigation, Education, and Application).
W91-07027 8B

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

HYDROLOGIC PROPERTIES

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

HYDROLOGICAL MODELS

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

HYDROLOGICAL REGIME

Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

HYDROLOGY

Historical Changes in the Columbia River Estuary.
W91-06288 2L

FRIENDS in Hydrology.
W91-06461 2E

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

Computation (Investigation, Education, and Application).
W91-07027 8B

HYDROLYSIS

Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

HYDROXIDE SLUDGE
Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

HYDROXYATRAZINE
Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

HYDROXYMETHANESULFONATE
Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

HYGROMETRY
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

ICE
Spreading of Oil Spilled Under Ice.
W91-07029 5B

ICE-WATER INTERFACES
Spreading of Oil Spilled Under Ice.
W91-07029 5B

ICEBERGS
Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

IDAHO
Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

IDAHO NATIONAL ENGINEERING LABORATORY
Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

ILLINOIS RIVER
Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

IMMUNE RESPONSES
Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

IMMUNOASSAY
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

IMMUNOCHEMISTRY
Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

IN SITU TREATMENT
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

INCINERATION
State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

INDIA
Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

INDICATORS
Review of Biochemical Methods and Other Indicators to Assess Fish Health in Aquatic Ecosystems Containing Toxic Chemicals.
W91-06920 5A

Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

INDUSTRIAL WASTES
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

Solvent Waste Reduction.
W91-06678 5D

Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

INDUSTRIAL WASTEWATER
River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

INFILTRATION
Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

Linkages with Ground Water.
W91-06743 2F

INFILTRATION CAPACITY
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

INFLUENT STREAMS
Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

INHIBITION
Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

INJECTION WELLS
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

INJURY
Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

INORGANIC COMPOUNDS
Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

INPUT-OUTPUT ANALYSIS
Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

INSECT CONTROL
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

INSECTICIDES
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

INSPECTION
Dam Safety Inspection Scheduling.
W91-06295 8G

INSTRUMENTATION
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

Measurement of Soil Water Potential.
W91-06415 2G

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

INTERNATIONAL AGREEMENTS
Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

INTERNATIONAL COMMISSIONS
Water Quality and Health (Review of the International Drinking Water Supply and Sanitation Decade).
W91-06064 5F

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

INTERNATIONAL HYDROLOGICAL DECADE
Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

INTERSTITIAL WATER
Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

INTERTIDAL AREAS
Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

INVERTEBRATES
Ecological Studies on the Hydromedusae, Siphonophores and Ctenophores in the Xiamen Harbor and Adjacent Waters.
W91-06106 2L

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

IODIDES
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

IODINE RADIOISOTOPES
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

ION EXCHANGE
Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

ION EXCHANGE CHROMATOGRAPHY
Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

ION EXCHANGE RESINS
Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

ION TRANSPORT
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

IRAN
Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

IRAQ
Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

IRELAND
Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

IRISH SEA
Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

IRON
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

IRON COMPOUNDS
Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

IRRIGATION
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

Effect of Pattern of Water Supply on Vicia faba L.: 1. Dry Matter Partitioning and Yield Variability.
W91-06932 3F

Effect of Pattern of Water Supply on Vicia Faba L.: 2. Pod Retention and Filling, and Dry Matter Partitioning, Production and Water Use.
W91-06934 3F

IRRIGATION EFFECTS
Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

Historical Changes in the Columbia River Estuary.
W91-06288 2L

Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

IRRIGATION EFFICIENCY
Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

Reduce Greenhouse Runoff.
W91-06403 3F

Water Use and Average Growth Index of Five Species of Container Grown Woody Landscape Plants.
W91-06420 3F

IRRIGATION MANAGEMENT
Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

IRRIGATION PRACTICES
Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Salinity--An Old Environmental Problem.
W91-07049 3C

IRRIGATION PROGRAMS
Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

IRRIGATION WATER
Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

ISLANDS
Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

ISOTOPE STUDIES
Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

ISOTOPIC TRACERS
Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

ISRAEL
Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

ITALY
Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

IVORY COAST
Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

JAMAICA
Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

JAPAN
Management and Status of Japanese Public Waters.
W91-06039 5G

Perspective of Water Resources in Japan and in the World.
W91-06040 6D

Recent Developments in Wastewater Management in Japan.
W91-06041 5G

River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

JAPAN

Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Erosion Research and Control in Japan.
W91-06572 4D

Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

JAVA

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

JELLY FISH

Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

JETTIES

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

JOGANJI RIVER

Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

KARIBA LAKE

Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

KENYA

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

KILLIFISH

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

KINEMATIC WAVE THEORY

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

KINETICS

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

KOREA

Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

KRIGING

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

KUWAIT

Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

LABORATORY METHODS

Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

Indoor Soil Erosion Research Facility.
W91-06232 2J

Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

LAGENIDIUM

Laboratory Evaluation of Lagenidium giganteum (Oomycetes: Lagenidiales) in Water from Contra Costa County, California, Mosquito Sources.
W91-06122 5G

LAGOONS

Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

LAKE ACIDIFICATION

Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

LAKE BASINS

Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

LAKE ECOLOGY

Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

LAKE ERIE
Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

LAKE FISHERIES
Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

LAKE KINNERET
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

LAKE MICHIGAN
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

LAKE MORPHOLOGY
Great Lakes Estuaries.
W91-06846 2H

LAKE ONALASKA
Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

LAKE RESTORATION
Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

LAKE SEDIMENTS
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

LAKE SOYANG
Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

LAKE SUPERIOR
Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

LAKES
Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

Great Lakes Estuaries.
W91-06846 2H

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

LAND APPLICATION
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Sludge Metal Bioavailability.
W91-06448 5B

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

LAND CLASSIFICATION
Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

LAND CLEARING
Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

LAND DEVELOPMENT
Growth Management: A Renewed Agenda for States.
W91-06227 6B

LAND DISPOSAL
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

Sludge Metal Bioavailability.
W91-06448 5B

Sludge Organics Bioavailability.
W91-06449 5B

Land and Liquid Disposal Bans.
W91-06679 5E

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

LAND LEVELING
Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

LAND MANAGEMENT
Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

Forest Hydrology and Watershed Management.
W91-06510 4C

Management of Forests with Water Conservation Function.
W91-06554 4A

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

LAND TREATMENT
Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

LAND USE
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Erosion and Sedimentation in the Pacific Rim.
W91-06570 2J

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

Cropping Systems: Ecology and Management.
W91-06741 3F

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

LANDFILLS
Above-Ground Landfill: The Engineered Approach.
W91-05969 5E

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Development of a Liquid Release Tester.
W91-06140 7B

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

LANDSLIDES
Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

LARRY DAMM CREEK
Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

LARVAE
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

LARVICIDES
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

LATERITES
Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

LATIN AMERICA
Sediment Budgets.
W91-07057 2J

LEACHATES
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

LEACHING
Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

LEAD
Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

Superfund Record of Decision: United Scrap Lead, OH.
W91-07051 5G

LEAD RADIOISOTOPES
Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

LEAVES
Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

LEGAL ASPECTS
Waste Minimization Liability Issues.
W91-06680 5G

LEGIONELLA
Legionella in Drinking Water.
W91-06210 5A

LEGISLATION
Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

Recent Developments in Wastewater Management in Japan.
W91-06041 5G

River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

River Basin Management in the UK.
W91-06045 6E

Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

Land and Liquid Disposal Bans.
W91-06679 5E

LEGUMES
Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

LETHAL LIMIT
Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

LEUKEMIA
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

LIABILITY
Waste Minimization Liability Issues.
W91-06680 5G

Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

LICHENS
Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

LIGHT EFFECTS
Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

LIGHT INTENSITY
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

LIGHT PENETRATION
Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

LIMITING NUTRIENTS
Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

LIMNOLOGY
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

LINDANE

Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

LINEAR ALKYL SULFONATES

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

LINKOU TERRACE

Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

LIPIDS

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

LIQUID CHROMATOGRAPHY

Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

LIQUID RELEASE TESTER

Development of a Liquid Release Tester.
W91-06140 7B

LITERATURE REVIEW

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

Metallothionein: A Potential Biomonitor of Exposure to Environmental Toxins.
W91-06188 5A

Sentinel Species and Sentinel Bioassay.
W91-06190 5A

LITTER

Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

LIVER

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

LOBSTERS

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

LOGGING

Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

Influence of Large Organic Debris on Channel Recovery in the Queen Charlotte Islands, British Columbia, Canada.
W91-06621 4C

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

LONG ISLAND SOUND

Sea Level Variability in Long Island Sound.
W91-06833 2L

LOS ANGELES

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

LOUISIANA

USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

LOW FLOW

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Low Flow Analysis.
W91-06505 2E

LUMINESCENCE
Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

LYSIMETERS
Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

MACROCYCLES
Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

MACROINVERTEBRATES
Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

MACROPHAGES
Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

MACROPHYTES
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

MAGNETIC STUDIES
Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

MALAYSIA
Development of Drinking Water Quality Surveillance in Malaysia.
W91-06065 5F

MAMMALS
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

MANAGEMENT PLANNING
Multicriterion Forest Watershed Resources Management.
W91-06569 6A

Project Management.
W91-06848 6A

National Response Team: A Report on the National Oil and Hazardous Substances Response System.
W91-07036 5G

MANGANESE
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

MANGROVE SWAMPS
Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

MANGROVE TREES
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

MANURE
Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

MAPPING
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

MARINE ALGAE
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

MARINE ANIMALS
Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

MARINE CLIMATES
Mechanisms of the Black Sea Circulation.
W91-06410 2B

MARINE ENVIRONMENT
Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

Ecological Studies on the Hydromedusae, Siphonophores and Ctenophores in the Xiamen Harbor and Adjacent Waters.
W91-06106 2L

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

MARINE FISHERIES
Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

MARINE LIFE
High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

MARINE POLLUTION
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

MARINE POLLUTION

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

MARINE SEDIMENTS

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

MARSH PLANTS

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

MARSHES

Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

MARYLAND

Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

MASS SPECTROMETRY

Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

MASS WASTING

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Sediment Routing by Debris Flow.
W91-06594 2J

Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

MASSACHUSETTS

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

MATERIALS TESTING

Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

MATHEMATICAL ANALYSIS

Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

MATHEMATICAL EQUATIONS

Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

MATHEMATICAL MODELS

Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

Spreading of Oil Spilled Under Ice.
W91-07029 5B

Optimal Spectral Base-Flow Estimation.
W91-07034 2E

Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

Mathematical Model for Reservoir Silting.
W91-07062 2J

Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

MATHEMATICAL STUDIES
Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

MAYFLIES
Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

MEANDERS
Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

MEASURING INSTRUMENTS
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

Development of a Liquid Release Tester.
W91-06140 7B

Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

Measurement of Soil Water Potential.
W91-06415 2G

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

MEDAKA
Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

MEDITERRANEAN SEA
Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

MEMBRANE FILTERS
Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

MEMBRANE PROCESSES
Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

Removing VOCs by Membrane Stripping.
W91-06814 5F

MEMBRANES
Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

Use of Membrane Technology in Florida.
W91-06809 3A

Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

Removing VOCs by Membrane Stripping.
W91-06814 5F

Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

MERCURIC CHLORIDE
Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

MERCURY
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L.).
W91-05998 5C

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

MESQUITE
Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

METABOLISM
Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

METABOLITES
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

METAL-FINISHING WASTES
Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

METALLOTHIONEINS
Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

Metallothionein: A Potential Biomonitor of Exposure to Environmental Toxins.
W91-06188 5A

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

METALLOTHIONEINS

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

METALS

Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

METEOROLOGY

Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

METHANOGENESIS

Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

METHYLCHOLANTHRENES

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

METHYLMERCURIC CHLORIDE

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

METHYLMERCURY

Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

MEXICO

DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

MICHIGAN

Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

MICROBIAL DEGRADATION

Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

MICROBIAL TRANSPORT

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

MICROBIOLOGICAL STUDIES

Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Tropical Source Water.
W91-06196 5F

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

Microbiology of Activated Carbon.
W91-06199 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Biofilms in Potable Water Distribution Systems.
W91-06206 5F

Waterborne Giardiasis.
W91-06207 5F

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Viruses in Source and Drinking Water.
W91-06212 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

MICROCYSTIS

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

MICROENVIRONMENT

Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

MICROFILTRATION

Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

MICROORGANISMS

Microbiology and Drinking Water Filtration.
W91-06200 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

MICROSCOPY

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

MICROSOMES
Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

MIDGES
Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

MILITARY RESERVATIONS
Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

MINE WASTES
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

MINERAL WATER
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

MINIMATA BAY
Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

MINIMUM FLOW
Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

MINING EFFECTS
High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

MINNESOTA
Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

MINNOW
Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

MISSISSIPPI RIVER
Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

MISSOURI RIVER
Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

MITOCHONDRIA
Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

MIXED-FUNCTION OXIDASE
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

MIXED-FUNCTION OXYGENASE
Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

MIXING
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

MODEL STUDIES
Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

Mechanisms of the Black Sea Circulation.
W91-06410 2B

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

FRIENDS in Hydrology.
W91-06461 2E

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Flood-Calculations in Norway.
W91-06502 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Low Flow Analysis.
W91-06505 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Time-Lapse Streamflow over North America.
W91-06509 2E

Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

Hydromechanical Erosion Model for Surface-Mined Areas.
W91-06599 4C

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Evolution of an Anthropogenic Desert Gully System.
W91-06721 2J

Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

Towards a Dynamic Model of Gully Growth.
W91-06725 2J

Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

Sea Level Variability in Long Island Sound.
W91-06833 2L

Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

Model of River Basin Evolution.
W91-07026 2J

Computation (Investigation, Education, and Application).
W91-07027 8B

Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

Spreading of Oil Spilled Under Ice.
W91-07029 5B

Surging in Urban Storm Drainage Systems.
W91-07033 5D

Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

Sediment Budgets.
W91-07057 2J

Mathematical Model for Reservoir Silting.
W91-07062 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

MODEL TESTING

Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

MOISTURE CONTENT

New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

MOISTURE PROFILES

Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

MOLLUSKS

Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

MOMENTUM TRANSFER

Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

MONITORING

Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

Biomarkers of Environmental Contamination.
W91-06176 5A

Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from

MONITORING

1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

Applications of Remote Sensing Techniques for the Inventory and Monitoring of Environmental Pollution.
W91-07052 7B

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

MONITORING WELLS

Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

MONOLINURON

Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

MONTANA

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

MOROCCO

Silting of Moroccan Dams.
W91-07065 2J

MORPHOLOGY

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

MORTALITY

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

MOSQUITOES

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

Laboratory Evaluation of Lagenidium giganteum (Oomycetes: Lagenidiales) in Water from Contra Costa County, California, Mosquito Sources.
W91-06122 5G

Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

MOUNT ST HELENS

Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

MOUNTAIN LAKES

Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

MOUNTAIN STREAMS

Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

MOUNTAIN WATERSHEDS

Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

MOUNTAINS

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

MT ST HELENS

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

MUD FLATS

Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

MULCHES

Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

MUMMICHOG

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

MUNICIPAL WASTES

Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

MUNICIPAL WASTEWATER

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

MURRAY-DARLING RIVER BASIN

Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

MUSSELS

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

MUTAGENICITY

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

MUTAGENS
Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

MYXOBACTERIA
Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

NAGASAKI
Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

NAPHTHALENES
Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

NATIONAL RESPONSE TEAM
National Response Team: A Report on the National Oil and Hazardous Substances Response System.
W91-07036 5G

NATURAL GAS
Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

NAVIGATION
Historical Changes in the Columbia River Estuary.
W91-06288 2L

NEARSHORE PROCESSES
Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

NEBRASKA
Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

NEPAL
Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

NERVOUS SYSTEM
Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

NETHERLANDS
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

NETWORK DESIGN
FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

NEUROTOXICITY
Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

NEUTRALIZATION
Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

NEUTRON ACTIVATION ANALYSIS
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

NEW BRUNSWICK
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

NEW ENGLAND
Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

NEW HAMPSHIRE
Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

NEW JERSEY
Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

NEW MEXICO
Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

NEW YORK
Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

Groundwater Seepage along a Barrier Island.
W91-06954 2F

NEW ZEALAND
Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

NEWFOUNDLAND
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

NICARAGUA
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

NICKEL
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

NIGERIA
Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

NIGERIA

Dynamics of Gully Head Recession in a Savanna Environment.
W91-06726 2J

Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

NITRATES

Water Treatment for Health Hazards.
W91-05977 5F

Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Sources of Nitrate to Ground Water.
W91-06733 5B

Nitrate in Ground Water in the United States.
W91-06734 5B

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

Linkages with Ground Water.
W91-06743 2F

Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

Economics of Nitrate Pollution.
W91-06790 5C

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

NITRIFICATION

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

NITROGEN

Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

Ten-Minute Digestion.
W91-06429 5D

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

NITROGEN COMPOUNDS

Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

Fertilizer Nitrogen Management.
W91-06738 3F

Estimation of N Budgets for Crops.
W91-06739 3F

Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

NITROGEN CYCLE

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Proper Accounting for N in Cropping Systems.
W91-06737 3F

Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

NITROGEN FIXATION

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

NONPOINT POLLUTION SOURCES

Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Sources of Nitrate to Ground Water.
W91-06733 5B

Nitrate in Ground Water in the United States.
W91-06734 5B

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

Proper Accounting for N in Cropping Systems.
W91-06737 3F

Fertilizer Nitrogen Management.
W91-06738 3F

Estimation of N Budgets for Crops.
W91-06739 3F

Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

Cropping Systems: Ecology and Management.
W91-06741 3F

Management of Water Balance Components.
W91-06742 3F

Linkages with Ground Water.
W91-06743 2F

Economics of Nitrate Pollution.
W91-06790 5C

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

NORFLURAZON

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

NORTH CAROLINA

Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

NORTH DAKOTA

Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

NORTH SEA

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

NORWAY

Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Analysis of Time Variability in Recessions.
W91-06471 2E

Flood-Calculations in Norway.
W91-06502 2E

Low Flow Analysis.
W91-06505 2E

NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

NOSTOC

Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

NUCLEAR EXPLOSIONS

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

NUCLEAR POWERPLANTS

Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

NUCLEAR REGULATORY COMMISSION

Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

NUCLEOSIDES

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

NUCLEOTIDES

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

NUMERICAL ANALYSIS

Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

NUTRIENT REQUIREMENTS

Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

Nutrient Needs.
W91-06398 3F

Estimation of N Budgets for Crops.
W91-06739 3F

NUTRIENT TRANSPORT

Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

NUTRIENTS

Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

Nutrient Needs.
W91-06398 3F

Reduce Greenhouse Runoff.
W91-06403 3F

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

NUTRITION

Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

OATS

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

OCEAN CIRCULATION

Mechanisms of the Black Sea Circulation.
W91-06410 2B

OCEANOGRAPHY

Historical Changes in the Columbia River Estuary.
W91-06288 2L

ODOR CONTROL
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

OIL
Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

OIL INDUSTRY
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

OIL POLLUTION
Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

OIL RECOVERY
Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

OIL SPILLS
Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

Spreading of Oil Spilled Under Ice.
W91-07029 5B

National Response Team: A Report on the National Oil and Hazardous Substances Response System.
W91-07036 5G

OIL WASTES
Minimizing Waste Oil Disposal.
W91-06168 5E

Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

OIL-WATER INTERFACES
Spreading of Oil Spilled Under Ice.
W91-07029 5B

OILY WATER
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

OKLAHOMA
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

OLFACTOMETRY
Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

OLFACTORY SYSTEM
Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

OLIGOCHAETES
Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

OLIGOTROPHIC LAKES
Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

ONCOGENES
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

ONTAKE LANDSLIDE
Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

ONTARIO
Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

OPEN-CHANNEL FLOW
Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

First-Order Analysis of Open-Channel Flow.
W91-06297 8B

OPEN SPACE
Growth Management: A Renewed Agenda for States.
W91-06227 6B

OPTICAL PROPERTIES
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

OREGON
Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Sediment Routing by Debris Flow.
W91-06594 2J

New Models of Hydrological and Stream Channel Relationships.
W91-06624 2F

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

ORGANIC ACIDS
Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

ORGANIC CARBON
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

ORGANIC COMPOUNDS
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

Sludge Organics Bioavailability.
W91-06449 5B

Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

ORGANIC MATTER
Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Sur-

face Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

ORGANIC POLLUTANTS
Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

ORGANIC SOLVENTS
Water Treatment for Health Hazards.
W91-05977 5F

ORGANIC WASTES
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

ORGANOCHLORINE PESTICIDES
Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

ORGANOMETALS
Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

ORGANOPHOSPHORUS PESTICIDES
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

ORGANOTIN COMPOUNDS
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

ORNAMENTALS
Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

OSMOREGULATION
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

OUTFALL SEWERS
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

OVERFLOW CHANNELS
Drownproofing of Low Overflow Structures.
W91-06294 8B

OVERFLOW STRUCTURES
Drownproofing of Low Overflow Structures.
W91-06294 8B

OVERLAND FLOW
Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

Empirical Relationships for the Transport Capacity of Overland Flow.
W91-06720 2J

Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

OXALIC ACID
Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

OXIDASE
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

OXIDATION
Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

OXIDATION DITCHES
Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

OXYGEN REQUIREMENTS
Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

OXYGEN TRANSFER
Oxygen Transfer in Trickling Filters.
W91-06864 5D

OXYGENASE
Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

OYSTERS
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

OYSTERS

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

OZONATION

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

PACIFIC RIM

Erosion and Sedimentation in the Pacific Rim.
W91-06570 2J

PALEOCLIMATOLOGY

Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

PALEOHYDROLOGY

Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

PAN EVAPORATION

Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

PAPUA NEW GUINEA

Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

PARAMETER ESTIMATION

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

PARANA RIVER

Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

PARAQUAT

Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

PARASITES

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

PARASITISM

Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

PARATHION

Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

PARTICLE SIZE

Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Critical Conditions for Bed Material Movement in Steep, Boulder-Bed Streams.
W91-06618 2J

Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

PARTICULATE MATTER

Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

PASTURE MANAGEMENT

Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

PASTURES

Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

PATH OF POLLUTANTS

Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

Hydrocarbon Bioaccumulation from Contaminated Sediment by the Deposit-Feeding Polychaete Abarenicola pacifica.
W91-06259 5B

Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

Sludge Organics Bioavailability.
W91-06449 5B

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Nitrate in Ground Water in the United States.
W91-06734 5B

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

Proper Accounting for N in Cropping Systems.
W91-06737 3F

Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

Linkages with Ground Water.
W91-06743 2F

Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

Spreading of Oil Spilled Under Ice.
W91-07029 5B

Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

Applications of Remote Sensing Techniques for the Inventory and Monitoring of Environmental Pollution.
W91-07052 7B

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

PATHOGENIC BACTERIA

Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Legionella in Drinking Water.
W91-06210 5A

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

PATHOGENIC FUNGI

Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

PATHOGENIC VIRUSES

Viruses in Source and Drinking Water.
W91-06212 5F

PAWCATUCK RIVER

Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

PEAK DISCHARGE

First-Order Analysis of Open-Channel Flow.
W91-06297 8B

PEAT

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

PEAT SOILS

Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

PENDIMETHALIN

Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

PENNSYLVANIA

Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

PENTACHLOROPHENOL

Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

PEPTIDES

Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

PERCH

Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

PERCOLATION

Linkages with Ground Water.
W91-06743 2F

PERFORMANCE EVALUATION

Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Efficiencies in Waste Processing.
W91-06171 5D

PERIPHYTON

Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

PERIPHYTON

Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

PERMITS
Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

PEROXISOMES
Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

PEROXYL RADICALS
Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

PERSIAN GULF
Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

PERU
Erosion and Sedimentation Issues in Peru.
W91-06571 2J

PESTICIDE DRIFT
Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

PESTICIDE EXTENDERS
Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

PESTICIDE KINETICS
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

PESTICIDE RESIDUES
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

PESTICIDE TOXICITY
Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

PESTICIDES
Water Treatment for Health Hazards.
W91-05977 5F

Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

PHENOLIC PESTICIDES
Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

PHENOLICS
Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

PHENOLS
Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

PHENOXY ACID HERBICIDES

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

PHENYLAMIDE HERBICIDES

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

PHEWA VALLEY

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

PHILIPPINES

Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

PHOSPHATASES

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

PHOSPHATES

Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

PHOSPHOMIDAN

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

PHOSPHORUS

Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

PHOSPHORUS COMPOUNDS

Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

PHOSPHORUS REMOVAL

Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

PHOSPHOTHIOATE PESTICIDES

Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

PHOTOCATALYTIC OXIDATION

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

PHOTOCATALYTIC REACTORS

Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

PHOTOCHEMISTRY

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

PHOTOGRAMMETRY

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

PHOTOLYSIS

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

PHOTOSYNTHESIS

Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

PHREATOPHYTES

Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

PHTHALATES

Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

PHYSICAL PROPERTIES

Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

PHYSICOCHEMICAL PROPERTIES

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

PHYSICOCHEMICAL TREATMENT

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

PHYSIOLOGICAL ECOLOGY

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

PHYTOPLANKTON

Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

PHYTOTOXICITY

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

PILOT PLANTS

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

PINE TREES

Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

PIPE FLOW
Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

PIPES
Flow in Damaged Pipe Networks.
W91-06296 8A

PIPING
Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

PLANKTON
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

PLANT DISEASES
Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

PLANT GROWTH
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

PLANT GROWTH SUBSTANCES
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

PLANT PHYSIOLOGY
Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

PLANT POPULATIONS
Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

PLANT WATER POTENTIAL
Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

Water Use and Average Growth Index of Five Species of Container Grown Woody Landscape Plants.
W91-06420 3F

PLANT-WATER RELATIONSHIPS
Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

PLASTICS
Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

PLATTE RIVER
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

PLUMES
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

PLUTONIUM
Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

POINT-OF-USE WATER TREATMENT
Home Treatment Devices and Water Quality.
W91-06201 5F

POLAND
Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

POLLUTANT IDENTIFICATION
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Biomarkers of Environmental Contamination.
W91-06176 5A

Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Legionella in Drinking Water.
W91-06210 5A

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Viruses in Source and Drinking Water.
W91-06212 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

Ten-Minute Digestion.
W91-06429 5D

Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organo-

phosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

New Strategies for Great Lakes Toxicology.
W91-06926 5A

Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

POLLUTANTS

Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

POLLUTION EFFECTS

Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

POLLUTION LOAD

Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

POLYCHAETES

Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

POLYCHLORINATED AROMATIC HYDROCARBONS

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

POLYCHLORINATED BIPHENYLS

Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

POLYCYCLIC AROMATIC HYDROCARBONS

Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

POLYELECTROLYTES

Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

POLYETHYLENE

Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

POLYMERS

Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

PONDS
Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

POPLAR CREEK
DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

POPULATION DENSITY
Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

POPULATION DYNAMICS
Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

POPULATION EXPOSURE
Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

PORE PRESSURE
Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

POROUS MEDIA
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

PORTLAND CEMENTS
Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

POTABLE WATER
Biofilms in Potable Water Distribution Systems.
W91-06206 5F

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

Desalting Practices in the United States.
W91-06808 3A

POTASSIUM
Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

POTATOES
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

POTOMAC RIVER
Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

POULTRY
Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

PRAIRIE FIRES
Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

PRAIRIES
Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

PRECIPITATION
Rain and Urban Stormwater Quality.
W91-06053 5B

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

PRECIPITATION SCAVENGING
Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

PREDATION
Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

PRESCRIBED BURNING
Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

PRESENCE-ABSENCE TEST
Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

PRESSURE HEAD
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

PRETREATMENT OF WASTES
Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

PRETREATMENT OF WASTEWATER
Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

PRETREATMENT OF WATER
Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

PRIEST RESERVOIR
Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

PRIMARY PRODUCTIVITY
Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

PRISTANE
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

PROCESS CONTROL
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

PRODUCTIVITY
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

PROJECT PLANNING
Project Management.
W91-06848 6A

PROTEINS
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

PROTOZOA
Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

Waterborne Giardiasis.
W91-06207 5F

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

PUBLIC HEALTH
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

Chemical Aspects of Water Quality and Health.
W91-05976 5F

Water Treatment for Health Hazards.
W91-05977 5F

Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

Water Quality and Health.
W91-06060 5C

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

Legionella in Drinking Water.
W91-06210 5A

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

PUBLIC POLICY
Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

PUBLIC WATERS
Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

PUERTO RICO
Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

PUGET SOUND
Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

PULP AND PAPER INDUSTRY
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

PULP WASTES
Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

PUYALLUP RIVER
Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

PYRENEES MOUNTAINS
Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

PYRETHRINS
Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

PYRETHROIDS
Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

QUALITY CONTROL
Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

QUANTITATIVE ANALYSIS
Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

QUEEN CHARLOTTE ISLANDS
Influence of Large Organic Debris on Channel Recovery in the Queen Charlotte Islands, British Columbia, Canada.
W91-06621 4C

QUINOLINE
Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

RADAR
Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

RADIOACTIVE HALF-LIFE
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

RADIOACTIVE TRACERS
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

RADIOACTIVE WASTE DISPOSAL
Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

RADIOACTIVE WASTE DISPOSAL

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

Minimizing Waste by Charging the Generator.
W91-06161 5E

Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

RADIOACTIVE WASTES

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes.
W91-06124 5E

Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

RADIOACTIVITY

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

RADIOACTIVITY EFFECTS

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

RADIOACTIVITY TECHNIQUES

Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

RADIOISOTOPES

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

RADIONUCLIDES

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

RADIUM

Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

RADON

Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

RAIN

Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

RAIN FORESTS

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

RAINBOW TROUT

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

RAINFALL

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

RAINFALL DISTRIBUTION

Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

RAINFALL ENERGY

Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

RAINFALL IMPACT

Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

RAINFALL INFILTRATION

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

RAINFALL RATE

Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

RAINFALL-RUNOFF RELATIONSHIPS
Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

RAINSTORMS
Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

RANGE MANAGEMENT
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

RATING CURVES
Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

RATS
Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

RECESSION
Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

RECIRCULATED WATER
Reduce Greenhouse Runoff.
W91-06403 3F

RECOLONIZATION
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

RECREATION
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

Economic Value of Wetlands-Based Recreation.
W91-06831 6B

Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

RECYCLING
Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Minimizing Waste Oil Disposal.
W91-06168 5E

Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

Making the Most of Bottoms and Residuals.
W91-06688 5D

Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

RED TIDE
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

REDUCTASES
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

REDWOOD CREEK
Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

REDWOOD CREEK BASIN
Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

REFLECTIVITY
Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

REFORESTATION
Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

REFUGIA
Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

REGIONAL ANALYSIS
Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

REGIONAL DEVELOPMENT
Growth Management: A Renewed Agenda for States.
W91-06227 6B

REGIONAL PLANNING
Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

REGRESSION ANALYSIS
Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

REGULATED FLOW
Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

REGULATIONS
Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

REMOTE SENSING
Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

Applications of Remote Sensing Techniques for the Inventory and Monitoring of Environmental Pollution.
W91-07052 7B

REPRODUCTION
Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

RESEARCH FACILITIES
William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

RESEARCH PRIORITIES
Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

RESERVOIR FISHERIES
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

RESERVOIR MANAGEMENT
Mathematical Model for Reservoir Silting.
W91-07062 2J

RESERVOIR SEDIMENTS
Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Mathematical Model for Reservoir Silting.
W91-07062 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

RESERVOIR SILTING
Mathematical Model for Reservoir Silting.
W91-07062 2J

Silting of Moroccan Dams.
W91-07065 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

RESERVOIRS
Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

RESIDENCE TIME
Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

RESOURCES DEVELOPMENT
Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

RESOURCES MANAGEMENT
Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Growth Management: A Renewed Agenda for States.
W91-06227 6B

RESPIRATION
Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

RESPIROMETRY
Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

RESTORATION
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

REVERSE OSMOSIS
Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

Use of Membrane Technology in Florida.
W91-06809 3A

Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

REVIEWS
Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

RHINE RIVER
Historical and Present Day Management of the River Rhine.
W91-06051 5G

RHIZOSPHERE
Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

RHODE ISLAND
Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

RICE
Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

RILL EROSION
Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

Indoor Soil Erosion Research Facility.
W91-06232 2J

RINGWOOD MINES/LANDFILL SITE
Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

RIPARIAN VEGETATION
Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

RIPRAP
Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

RISK ASSESSMENT
Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

Use of Biomarkers in Ecological Risk Assessment.
W91-06193 5A

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Environmental Risk Assessment/Environmental Hazard Assessment: Similarities and Differences.
W91-06692 5C

Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

Chlorination of Drinking Water and Cancer.
W91-06898 5F

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

RIVER BASIN DEVELOPMENT
River Basin Management in the UK.
W91-06045 6E

Model of River Basin Evolution.
W91-07026 2J

RIVER BASINS
River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

Model of River Basin Evolution.
W91-07026 2J

Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

RIVER BEDS
Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

RIVER FLOW
Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

RIVER MANAGEMENT
Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

RIVER REGULATIONS
River Basin Management in the UK.
W91-06045 6E

RIVER SEDIMENTS
Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

RIVER SEDIMENTS

Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

Study of the Total Load Transport by the Yellow River.
W91-07108 2J

Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

RIVER SYSTEMS

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

RIVER WAAL

Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

RIVERS

Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

ROAD CONSTRUCTION

Erosional Effects of Road Construction in Pi-Lu Experimental Watershed.
W91-06608 2J

ROADS

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

ROCK CREEK

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

ROCKS

Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

ROCKSLIDES

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

ROMANIA

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

Relationship Between Sediment Delivery Ratio and Stream Order: a Romanian Case Study.
W91-06722 2J

Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

ROOT ZONE

Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

ROTAVIRUSES

Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

RUNOFF

Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

RUNOFF FORECASTING
Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

RUNOFF RATES
Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

RURAL AREAS
Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

Domestic Water Treatment for Developing Countries.
W91-06202 5F

S-ETHYL DIPROPYLTHIOCARBAMATE
Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

S-GLUTATHIONE ATRAZINE
Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

SACCHAROMYCES
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

SACO RIVER
Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

SALINE-FRESHWATER INTERFACES
Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

Groundwater Seepage along a Barrier Island.
W91-06954 2F

Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

SALINE GROUNDWATER
Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

Groundwater Seepage along a Barrier Island.
W91-06954 2F

SALINE SOILS
Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

SALINE WATER
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

Salinity--An Old Environmental Problem.
W91-07049 3C

SALINE WATER INTRUSION
Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

SALINITY
Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

Salinity--An Old Environmental Problem.
W91-07049 3C

SALMON
Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

SALMONELLA
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

SALT MARSHES
Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

SALT STRESS
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

SALT TOLERANCE
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

SALTSTONE
Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

SAMPLE PREPARATION
Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

SAMPLE PREPARATION

Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

SAMPLE PRESERVATION

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

SAMPLERS

Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

SAMPLING

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

SAN FRANCISCO BAY

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

SAN JOAQUIN VALLEY

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

SAND

Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

SAND FILTERS

Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

SANDSPITS

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

SANITARY ENGINEERING

Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

SANITATION

Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

SANTA CRUZ MOUNTAINS

Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

SANTA CRUZ RIVER BASIN

Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

SANTA YNEZ RIVER

Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

SATELLITE TECHNOLOGY

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

SAUDI ARABIA

Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

SAVANNAS

Dynamics of Gully Head Recession in a Savanna Environment.
W91-06726 2J

Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

SCALE FACTORS

From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

SCANNING ELECTRON MICROSCOPY

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

SCOTLAND

Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

SCOUR

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

SCULPIN

Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

SEA GRASSES

Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

SEA LEVEL

Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

Effect of Climate Change on Sea Level Rise and the Implications for World Agriculture.
W91-06416 5C

Sea Level Variability in Long Island Sound.
W91-06833 2L

SEA MUSSELS
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

SEA NETTLES
Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

SEA URCHINS
Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

SEABASSES
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

SEASONAL VARIATION
Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

SEAWATER
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

SECONDARY PRODUCTIVITY
Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

SEDIMENT ANALYSIS
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

SEDIMENT BUDGET
Sediment Budgets.
W91-07057 2J

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

SEDIMENT CONCENTRATION
Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

SEDIMENT CONTAMINATION
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melano-macrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

SEDIMENT CONTROL
Vortex-Settling Basin Design Considerations.
W91-06292 8B

SEDIMENT DISCHARGE
Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

SEDIMENT DISCHARGE

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

SEDIMENT DISTRIBUTION

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

SEDIMENT EROSION

Sediment Budgets.
W91-07057 2J

Sediment Losses from Cropland Furrows.
W91-07058 2J

Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

SEDIMENT LOAD

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

Study of the Total Load Transport by the Yellow River.
W91-07108 2J

SEDIMENT ROUTING

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

SEDIMENT SAMPLER

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

SEDIMENT SAMPLING

Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

SEDIMENT SORTING

Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

SEDIMENT SOURCES

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

SEDIMENT TRANSPORT

Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

Sediment Routing by Debris Flow.
W91-06594 2J

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

Erosion Processes and Effects of Debris Flow.
W91-06596 2J

Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

Erosion, Transport and Deposition Processes.
W91-06717 2J

Empirical Relationships for the Transport Capacity of Overland Flow.
W91-06720 2J

Relationship Between Sediment Delivery Ratio and Stream Order: a Romanian Case Study.
W91-06722 2J

Towards a Dynamic Model of Gully Growth.
W91-06725 2J

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

Sediment Budgets.
W91-07057 2J

Sediment Losses from Cropland Furrows.
W91-07058 2J

Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

Mathematical Model for Reservoir Silting.
W91-07062 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

Silting of Moroccan Dams.
W91-07065 2J

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du

Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

Study of the Total Load Transport by the Yellow River.
W91-07108 2J

Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

SEDIMENT YIELD

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

Erosional Effects of Road Construction in Pi-Lu Experimental Watershed.
W91-06608 2J

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

SEDIMENTARY BASINS

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

SEDIMENTATION

Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

Erosion and Sedimentation in the Pacific Rim.
W91-06570 2J

Erosion and Sedimentation Issues in Peru.
W91-06571 2J

Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

Sediment Budgets.
W91-07057 2J

Sediment Losses from Cropland Furrows.
W91-07058 2J

Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

Mathematical Model for Reservoir Silting.
W91-07062 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

Silting of Moroccan Dams.
W91-07065 2J

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

SEDIMENTATION RATES

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

SEDIMENTOLOGY

Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

SEDIMENTS

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

Vortex-Settling Basin Design Considerations.
W91-06292 8B

Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

SEEDLINGS

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

SEEPAGE
Groundwater Seepage along a Barrier Island.
W91-06954 2F

SEEPAGE LOSS
Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

SEISMIC EXPLORATION
Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

SELENASTRUM
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

SELENIUM
Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

Determination of Soluble Selenium in Soils.
W91-06970 5A

Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

SEMIARID LANDS
Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

SENSITIVITY ANALYSIS
Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

SENSORS
Nutrient Needs.
W91-06398 3F

SEPARATION TECHNIQUES
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

Efficiencies in Waste Processing.
W91-06171 5D

Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

Solid/Liquid Separation: Waste Management and Productivity Enhancement.
W91-06421 5D

Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

Thin Cake Filtration: Theory and Practice.
W91-06425 5D

Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

SEPTIC TANKS
Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

SEPTIC WASTEWATER
Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

SEQUESTRATION
Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

SETTLING BASINS
Vortex-Settling Basin Design Considerations.
W91-06292 8B

SEWAGE
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

SEWER HYDRAULICS
Surging in Urban Storm Drainage Systems.
W91-07033 5D

SEXUAL CYCLE
Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

SHAD
Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

SHATT AL-BASRAH CANAL
Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

SHEAR STRESS
Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

SHEET EROSION
Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

SHIPS
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

SHOALS
Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

SHRIMP
Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

SIERRA NEVADA
Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

SIEVE ANALYSIS
Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

SILICA
Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

SILICATES
Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

SILT LOAD
Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

SIMAZINE
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

SIMULATED RAINFALL
Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

SIMULATION ANALYSIS
Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

SINGAPORE
Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

SITE REMEDIATION
Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

SLACKWATERS
Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

SLOPE DEGRADATION
Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

SLOPE EFFECTS
Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

SLOPE PROTECTION
Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

SLOPE STABILITY
Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

SLOPES
Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

SLUDGE
Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

Surface Charge on Wastewater Sludges.
W91-06439 5D

Sludge Metal Bioavailability.
W91-06448 5B

Sludge Organics Bioavailability.
W91-06449 5B

SLUDGE CAKE
Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

SLUDGE CONDITIONING
Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

Surface Charge on Wastewater Sludges.
W91-06439 5D

SLUDGE DIGESTION
Solid/Liquid Separation: Waste Management and Productivity Enhancement.
W91-06421 5D

Ten-Minute Digestion.
W91-06429 5D

SLUDGE DISPOSAL
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

Sludge Organics Bioavailability.
W91-06449 5B

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

SLUDGE DRYING
Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

SLUDGE THICKENING
Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

SLUDGE TREATMENT
Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

SLUDGE UTILIZATION
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Sludge Metal Bioavailability.
W91-06448 5B

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

SMALL WATERSHEDS
Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

SNAILS
Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

SNOW
Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

SNOW ACCUMULATION
Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

SNOW COVER
Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

SNOW MANAGEMENT
Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

SNOWMELT
Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

SNOWPACK
Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

SOCIAL ASPECTS
Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

SODIUM NITRATE
Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

SOIL AGGREGATES
Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

Shrinkage of Dutch Clay Soil Aggregates.
W91-06935 2G

Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

SOIL ALGAE
Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

SOIL AMENDMENTS
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

SOIL ANALYSIS
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

SOIL CHEMISTRY
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

Effect of the Composition of Soil Solutions and Exchange Cations on Water Retention and Hydraulic Conductivity.
W91-05980 2G

Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

Determination of Soluble Selenium in Soils.
W91-06970 5A

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

SOIL CLASSIFICATION

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

SOIL COMPACTION

Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

SOIL CONSERVATION

Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

Soil Erosion Studies in Peru.
W91-06277 4D

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

SOIL CONTAMINATION

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

Sludge Metal Bioavailability.
W91-06448 5B

Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

Economics of Nitrate Pollution.
W91-06790 5C

Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

SOIL CREEP

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

SOIL ENGINEERING

Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

SOIL EROSION

USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

Indoor Soil Erosion Research Facility.
W91-06232 2J

Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

Soil Erosion Studies in Peru.
W91-06277 4D

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

Erosion Research and Control in Japan.
W91-06572 4D

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

Hydromechanical Erosion Model for Surface-Mined Areas.
W91-06599 4C

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

Sediment Losses from Cropland Furrows.
W91-07058 2J

Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

SOIL FUNGI

Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

SOIL GENESIS

Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

SOIL MANAGEMENT

Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

SOIL MOISTURE DEFICIENCY

Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

SOIL MOISTURE RETENTION

Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

SOIL ORGANIC MATTER

Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

SOIL ORGANISMS

Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

SOIL PHYSICAL PROPERTIES

Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

SOIL POROSITY

Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

SOIL PROPERTIES

Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

SOIL SCIENCE

Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

Measurement of Soil Water Potential.
W91-06415 2G

SOIL SOLUTION

Effect of the Composition of Soil Solutions and Exchange Cations on Water Retention and Hydraulic Conductivity.
W91-05980 2G

Determination of Soluble Selenium in Soils.
W91-06970 5A

SOIL STRUCTURE

Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

Effect of the Composition of Soil Solutions and Exchange Cations on Water Retention and Hydraulic Conductivity.
W91-05980 2G

SOIL SURFACES

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

SOIL TEXTURE

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

SOIL TREATMENT

Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

SOIL TYPES

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

SOIL WATER

Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Measurement of Soil Water Potential.
W91-06415 2G

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

SOIL-WATER-PLANT RELATIONSHIPS

Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

SOIL WATER POTENTIAL

Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

Measurement of Soil Water Potential.
W91-06415 2G

SOILS

Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

Determination of Soluble Selenium in Soils.
W91-06970 5A

Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

SOLAR RADIATION

Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

SOLID WASTES

Above-Ground Landfill: The Engineered Approach.
W91-05969 5E

Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

SOLUBILITY

Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

SOLUTE TRANSPORT

Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo

(Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

SOLUTES
Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

SOLVENT EXTRACTION
Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

SOLVENTS
Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Solvent Waste Reduction.
W91-06678 5D

Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

Source Reduction--Parts Cleaning.
W91-06682 5E

Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

SONORAN DESERT
William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

SORGHUM
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

SORPTION
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

SOUTH AFRICA
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

SOUTH AMERICA
Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

SOUTH CAROLINA
Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

SOVIET UNION
Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

SPADA LAKE
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

SPAIN
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

Towards a Dynamic Model of Gully Growth.
W91-06725 2J

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

SPATIAL DISTRIBUTION
Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

SPATIAL VARIATION
Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

SPAWNING
Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

SPECIES COMPOSITION
Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

SPECIES COMPOSITION

Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

SPECIES DIVERSITY

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

SPOIL BANKS

Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

SPORT FISHING

Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

SPRINGS

Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

SPRUCE TREES

Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

STAGE-DISCHARGE RELATIONS

First-Order Analysis of Open-Channel Flow.
W91-06297 8B

STANDPIPES

Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

STAPHYLOCOCCUS

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

STARVATION

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

STATISTICAL ANALYSIS

Statistical Approaches to Monitoring.
W91-06214 5A

Determination of Soluble Selenium in Soils.
W91-06970 5A

STATISTICAL METHODS

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

STATISTICAL STUDIES

Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

STATISTICS

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

STEAM EXTRACTION

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

STEMFLOW

Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

STOCHASTIC MODELS

Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

STORM DRAINS

Surging in Urban Storm Drainage Systems.
W91-07033 5D

STORM RUNOFF

Rain and Urban Stormwater Quality.
W91-06053 5B

Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Surging in Urban Storm Drainage Systems.
W91-07033 5D

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

STORM WATER

Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

STORM WATER MANAGEMENT

Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

STORMS

Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

STRATIFICATION

Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

STRATIFIED FLOW

Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

STREAM BIOTA

Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

STREAM CHEMISTRY

Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

STREAM CLASSIFICATION

Relationship Between Sediment Delivery Ratio and Stream Order: a Romanian Case Study.
W91-06722 2J

STREAM DISCHARGE

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

Optimal Spectral Base-Flow Estimation.
W91-07034 2E

STREAM DIVERSION

Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

STREAM FISHERIES

Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

STREAM GAGES

Optimal Spectral Base-Flow Estimation.
W91-07034 2E

STREAM IMPROVEMENT
Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

STREAM MORPHOLOGY
Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

STREAM ORDER
Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

STREAM POLLUTION
Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

STREAMFLOW
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Low Flow Analysis.
W91-06505 2E

Time-Lapse Streamflow over North America.
W91-06509 2E

Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

Optimal Spectral Base-Flow Estimation.
W91-07034 2E

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

STREAMFLOW FORECASTING
First-Order Analysis of Open-Channel Flow.
W91-06297 8B

Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

FRIENDS in Hydrology.
W91-06461 2E

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Analysis of Time Variability in Recessions.
W91-06471 2E

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Regional Analysis of Flow Duration Curves.
W91-06484 2E

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Flood-Calculations in Norway.
W91-06502 2E

Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Low Flow Analysis.
W91-06505 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

Time-Lapse Streamflow over North America.
W91-06509 2E

Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

STREAMS
Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

STREPTOCOCCI
Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

STRESS
Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

STRIP MINES
Hydromechanical Erosion Model for Surface-Mined Areas.
W91-06599 4C

STRIPED BASS
Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

STRONTIUM
Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

STRONTIUM RADIOISOTOPES
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

STRUCTURE-ACTIVITY RELATIONSHIPS
Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

SUBLETHAL EFFECTS
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

SUBSTRATES
Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

SUBSURFACE DRAINAGE
USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

SUCCESSION
Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

SULFATES
Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

SULFIDES
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

SULFUR
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

SULFUR BACTERIA
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

SULFUR COMPOUNDS
Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

SULFUR CYCLE
Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

SULFURIC ACID
Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

SUNFISH
Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

SUPERCRITICAL WATER OXIDATION
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

SUPERFUND
Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

SURFACE DRAINAGE
Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

SURFACE ENCAPSULATION
Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

SURFACE-GROUNDWATER RELATIONS
Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Optimal Spectral Base-Flow Estimation.
W91-07034 2E

SURFACE RUNOFF
Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

SURFACE WATER
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

SURFACTANTS
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

SURVEYS
Waste Reduction Audits: Matching Types to Stages.
W91-06162 5E

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

SUSPENDED LOAD
Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

SUSPENDED SEDIMENTS
Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Suspended Sediment Routing along a Reservoir.
W91-07070 2J

Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets

SUSPENDED SEDIMENTS

(Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

SUSPENDED SOLIDS

Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

SUSQUEHANNA RIVER

Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07053 5G

SWALES

Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

SWAMPS

Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

SWAN COASTAL PLAIN

Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

SWEDEN

Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

SWIMMING

Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

SWITZERLAND

Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

SYMPOSIUM

Hazardous and Industrial Solid Waste Minimization Practices.
W91-06158 5E

Forest Hydrology and Watershed Management.
W91-06510 4C

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Sediment Budgets.
W91-07057 2J

SYNERGISTIC EFFECTS

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

SYNTHETIC COMPOUNDS

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

TAILWATER

Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

TAIWAN

Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

Erosional Effects of Road Construction in Pi-Lu Experimental Watershed.
W91-06608 2J

TEMPERATURE EFFECTS

Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

Psychrophilic Anaerobic Digestion of Animal Manure: Proposed Design Methodology.
W91-06225 5D

Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

TEMPORAL VARIATION

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

TENNESSEE

Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

TENSIOMETERS

Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

TERATOGENIC EFFECTS

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

TERNS

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

TERRACING

Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

TERRAIN ANALYSIS

Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

TERTIARY WASTEWATER TREATMENT

Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

TEST PROCEDURES

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

TESTING PROCEDURES
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Development of a Liquid Release Tester.
W91-06140 7B

Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

TETRACHLORODIBENZO-P-DIOXIN
Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

TETRACHLORODIBENZOFURANS
Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

TEXAS
Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

THAILAND
Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

THAMES RIVER
Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

THE NETHERLANDS
Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

Shrinkage of Dutch Clay Soil Aggregates.
W91-06935 2G

Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

THIOCARBAMATE PESTICIDES
Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

THROUGHFALL
Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

TIDAL CURRENTS
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

TIDAL EFFECTS
Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

TIDAL FLATS
Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

TIDAL HYDRAULICS
Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

Sea Level Variability in Long Island Sound.
W91-06833 2L

TIDAL MARSHES
Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

TIDAL RIVERS
Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

TIDAL WAVES
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

TIDES
Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

TIGER SHRIMP
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

TIGRIS RIVER
Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

TILAPIA
Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

TILLAGE
Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposi-

tion and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

TIME-LAPSE MAPPING
Time-Lapse Streamflow over North America.
W91-06509 2E

TIME SERIES ANALYSIS
Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

TISSUE ANALYSIS
Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

TOKYO
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

TOPOGRAPHY
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

TORRENTS
Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

TOXAPHENES
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

TOXIC WASTES
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

TOXICITY
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

Biological Monitoring: Testing for Genotoxicity.
W91-06183 5A

Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06875 5C

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

TOXICOLOGY

Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-

Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melano-macrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Environmental Risk Assessment/Environmental Hazard Assessment: Similarities and Differences.
W91-06692 5C

Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

New Strategies for Great Lakes Toxicology.
W91-06926 5A

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

TOXICOLOGY

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

TOXINS

Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

TOXORHYNCHITES

Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

TRACE ELEMENTS

Chemical Aspects of Water Quality and Health.
W91-05976 5F

Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

TRACE LEVELS

Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

TRACE METALS

Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

TRACERS

Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

TRANSPIRATION

Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

TRAVELTIME

Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

TREES

Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

TRENT RIVER BASIN

Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

TRIAZINE HERBICIDES

Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

TRIAZINE PESTICIDES

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

TRIBUTARIES

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

TRICHLOROETHYLENE

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

TRICKLING FILTERS

Oxygen Transfer in Trickling Filters.
W91-06864 5D

TRIHALOMETHANES

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

Chlorination of Drinking Water and Cancer.
W91-06898 5F

TRIPHENYLTINS
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

TRITIUM
Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

TROPICAL REGIONS
Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Tropical Source Water.
W91-06196 5F

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

TROUT
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

TURBIDITY
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

TURBIDITY CURRENTS
Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

TURBULENT FLOW
Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

TURF GRASSES
Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

TURGIDITY
Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

TURTLES
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

TYPHOONS
Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

ULTRAFILTRATION
Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

ULTRASONICS
Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

ULTRAVIOLET RADIATION
Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

UNCERTAINTY
Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

UNGAGED BASINS
Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

UNGAGED BASINS

Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

UNIT HYDROGRAPHS
Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

UNITED NATIONS
FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

UNITED SCRAP LEAD SITE
Superfund Record of Decision: United Scrap Lead, OH.
W91-07051 5G

UNITED STATES
Time-Lapse Streamflow over North America.
W91-06509 2E

Nitrate in Ground Water in the United States.
W91-06734 5B

Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

UNIVERSAL SOIL LOSS EQUATION
USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

UNSTEADY FLOW
Surging in Urban Storm Drainage Systems.
W91-07033 5D

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

UPPER NAN RIVER
Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

URANIUM
Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

URBAN AREAS
Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

URBAN HYDROLOGY
Rain and Urban Stormwater Quality.
W91-06053 5B

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

Surging in Urban Storm Drainage Systems.
W91-07033 5D

URBAN RUNOFF
River Catchment Planning for Land Drainage, Flood Defence and the Environment.
W91-05971 4A

Rain and Urban Stormwater Quality.
W91-06053 5B

Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

URBANIZATION
Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

USSR
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

VALLEYS
Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

VECTOBAC
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

VEGETATION
Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

VEGETATION EFFECTS
Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

VERMONT
Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

VERTEBRATES
Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

VIGO ESTUARY
Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

VIRGINIA
Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

VIRUSES
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Viruses in Source and Drinking Water.
W91-06212 5F

Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

VISION HERBICIDE
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

VOLATILE ORGANIC COMPOUNDS
Water Treatment for Health Hazards.
W91-05977 5F

Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

Removing VOCs by Membrane Stripping.
W91-06814 5F

VOLATILE SOLIDS
Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

VOLATILITY
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

VOLCANOES
Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

VOLTAMMETRY
In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

WALES
Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

WASH WATER
Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

WASHINGTON
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

WASTE ANALYSIS
Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

WASTE CHARACTERISTICS
Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

Surface Charge on Wastewater Sludges.
W91-06439 5D

WASTE CONTAINMENT
Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

WASTE DISPOSAL
Above-Ground Landfill: The Engineered Approach.
W91-05969 5E

Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes.
W91-06124 5E

Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Development of a Liquid Release Tester.
W91-06140 7B

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

Hazardous and Industrial Solid Waste Minimization Practices.
W91-06158 5E

Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

Minimizing Waste by Charging the Generator.
W91-06161 5E

Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

Minimizing Waste Oil Disposal.
W91-06168 5E

Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

Solvent Waste Reduction.
W91-06678 5D

Land and Liquid Disposal Bans.
W91-06679 5E

Waste Minimization Liability Issues.
W91-06680 5G

Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Making the Most of Bottoms and Residuals.
W91-06688 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

WASTE LOAD ALLOCATION

Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

WASTE MANAGEMENT

Above-Ground Landfill: The Engineered Approach.
W91-05969 5E

Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

Minimizing Waste by Charging the Generator.
W91-06161 5E

Waste Reduction Audits: Matching Types to Stages.
W91-06162 5E

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

Efficiencies in Waste Processing.
W91-06171 5D

Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

Solid/Liquid Separation: Waste Management and Productivity Enhancement.
W91-06421 5D

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

WASTE RECOVERY

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Minimizing Waste Oil Disposal.
W91-06168 5E

Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

Efficiencies in Waste Processing.
W91-06171 5D

Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

WASTE REDUCTION

Hazardous and Industrial Solid Waste Minimization Practices.
W91-06158 5E

Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

Minimizing Waste by Charging the Generator.
W91-06161 5E

Waste Reduction Audits: Matching Types to Stages.
W91-06162 5E

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Minimizing Waste Oil Disposal.
W91-06168 5E

Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

Waste Minimization Liability Issues.
W91-06680 5G

Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

WASTE REDUCTION AUDITS

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

WASTE SOLIDIFICATION

Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes.
W91-06124 5E

Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Development of a Liquid Release Tester.
W91-06140 7B

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

WASTE STABILIZATION

Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes.
W91-06124 5E

Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

WASTE TREATMENT

Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes.
W91-06124 5E

Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

Hazardous and Industrial Solid Waste Minimization Practices.
W91-06158 5E

Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

Efficiencies in Waste Processing.
W91-06171 5D

Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

Solvent Waste Reduction.
W91-06678 5D

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

Making the Most of Bottoms and Residuals.
W91-06688 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

WASTE UTILIZATION

Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

WASTEWATER

Recent Developments in Wastewater Management in Japan.
W91-06041 5G

WASTEWATER ANALYSIS

Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

WASTEWATER DISPOSAL

Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

WASTEWATER FACILITIES

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

WASTEWATER IRRIGATION

Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

WASTEWATER LAGOONS

Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

WASTEWATER MANAGEMENT

Recent Developments in Wastewater Management in Japan.
W91-06041 5G

River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

WASTEWATER POLLUTION

Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

WASTEWATER REACTORS

Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

WASTEWATER RENOVATION

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

WASTEWATER REUSE

Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

WASTEWATER TREATMENT

Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

Recent Developments in Wastewater Management in Japan.
W91-06041 5G

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Solid/Liquid Separation: Waste Management and Productivity Enhancement.
W91-06421 5D

Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

Thin Cake Filtration: Theory and Practice.
W91-06425 5D

Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

Ten-Minute Digestion.
W91-06429 5D

Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

Surface Charge on Wastewater Sludges.
W91-06439 5D

Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

Oxygen Transfer in Trickling Filters.
W91-06864 5D

Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

WATER ANALYSIS

Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

WATER BIRDS

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

WATER BOUNDARY

Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

WATER CHEMISTRY

Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

WATER CIRCULATION

Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

WATER CONSERVATION

Isle of Wight Water Metering Trial.
W91-05966 3F

Network Management--the Bradford Experience.
W91-05967 5F

Perspective of Water Resources in Japan and in the World.
W91-06040 6D

Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

Management of Forests with Water Conservation Function.
W91-06554 4A

Management of Water Balance Components.
W91-06742 3F

WATER CONVEYANCE

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Biofilms in Potable Water Distribution Systems.
W91-06206 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Flow in Damaged Pipe Networks.
W91-06296 8A

WATER CURRENTS

Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

WATER DELIVERY

Flow in Damaged Pipe Networks.
W91-06296 8A

WATER DEMAND

Network Management--the Bradford Experience.
W91-05967 5F

Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

WATER DISTRIBUTION

Network Management--the Bradford Experience.
W91-05967 5F

Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

Flow in Damaged Pipe Networks.
W91-06296 8A

WATER DISTRICTS

Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

WATER EXCHANGE

Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

WATER HYACINTH

Water Hyacinth Growth in Anaerobic Digester Effluents.
W91-06222 5D

WATER LAW

Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

River Basin Management in the UK.
W91-06045 6E

Water Resource Planning in Canada.
W91-06230 6E

Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

WATER LEVEL FLUCTUATIONS

Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

WATER MANAGEMENT

Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

WATER MASSES

Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

WATER METERING

Isle of Wight Water Metering Trial.
W91-05966 3F

WATER POLICY

River Basin Management in the UK.
W91-06045 6E

Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Water Resource Planning in Canada.
W91-06230 6E

WATER POLLUTION

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

WATER POLLUTION CONTROL

Management and Status of Japanese Public Waters.
W91-06039 5G

River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

River Basin Management in the UK.
W91-06045 6E

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

Historical and Present Day Management of the River Rhine.
W91-06051 5G

Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

Water Resource Planning in Canada.
W91-06230 6E

Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

Agriculture's Role in Protecting Water Quality.
W91-06305 5G

Nutrient Needs.
W91-06398 3F

Proper Accounting for N in Cropping Systems.
W91-06737 3F

Fertilizer Nitrogen Management.
W91-06738 3F

Estimation of N Budgets for Crops.
W91-06739 3F

Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

Cropping Systems: Ecology and Management.
W91-06741 3F

Management of Water Balance Components.
W91-06742 3F

Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

WATER POLLUTION EFFECTS

Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

Biomarkers of Environmental Contamination.
W91-06176 5A

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

Biological Monitoring: Testing for Genotoxicity.
W91-06183 5A

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

Metallothionein: A Potential Biomonitor of Exposure to Environmental Toxins.
W91-06188 5A

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Sentinel Species and Sentinel Bioassay.
W91-06190 5A

Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

Use of Biomarkers in Ecological Risk Assessment.
W91-06193 5A

Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollu-

tion Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melano-macrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

Aquatic Toxicology and Risk Assessment.
W91-06691 5C

Environmental Risk Assessment/Environmental Hazard Assessment: Similarities and Differences.
W91-06692 5C

Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

Health of Latin Americans Exposed to Polluted Rivers: A Triple-Blind Observational Study.
W91-06916 5C

Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Review of Biochemical Methods and Other Indicators to Assess Fish Health in Aquatic Ecosystems Containing Toxic Chemicals.
W91-06920 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

Observations on Fish Community Health.
W91-06930 5A

Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

WATER POLLUTION PREVENTION

Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

WATER POLLUTION SOURCES

Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Tropical Source Water.
W91-06196 5F

Viruses in Source and Drinking Water.
W91-06212 5F

Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

Nitrogen Management and Ground Water Protection.
W91-06731 3F

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

Sources of Nitrate to Ground Water.
W91-06733 5B

Nitrate in Ground Water in the United States.
W91-06734 5B

WATER POLLUTION SOURCES

Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

Fertilizer Nitrogen Management.
W91-06738 3F

Estimation of N Budgets for Crops.
W91-06739 3F

Economics of Nitrate Pollution.
W91-06790 5C

Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

Salinity--An Old Environmental Problem.
W91-07049 3C

Superfund Record of Decision: United Scrap Lead, OH.
W91-07051 5G

Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

WATER POLLUTION TREATMENT

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

WATER QUALITY

Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Chemical Aspects of Water Quality and Health.
W91-05976 5F

Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

Management and Status of Japanese Public Waters.
W91-06039 5G

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Tropical Source Water.
W91-06196 5F

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

Microbiology of Activated Carbon.
W91-06199 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

Domestic Water Treatment for Developing Countries.
W91-06202 5F

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

WATER QUALITY CONTROL

Management and Status of Japanese Public Waters.
W91-06039 5G

Recent Developments in Wastewater Management in Japan.
W91-06041 5G

Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

Water Quality and Health.
W91-06060 5C

Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

Water Quality and Health (Review of the International Drinking Water Supply and Sanitation Decade).
W91-06064 5F

Development of Drinking Water Quality Surveillance in Malaysia.
W91-06065 5F

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Microbiology of Activated Carbon.
W91-06199 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

WATER QUALITY MANAGEMENT

Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

Historical and Present Day Management of the River Rhine.
W91-06051 5G

Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

WATER QUALITY MONITORING
Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

WATER QUALITY STANDARDS
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

Chemical Aspects of Water Quality and Health.
W91-05976 5F

Management and Status of Japanese Public Waters.
W91-06039 5G

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

Water Quality and Health.
W91-06060 5C

Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

WATER RESOURCES
Perspective of Water Resources in Japan and in the World.
W91-06040 6D

WATER RESOURCES DEVELOPMENT
Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

Desalting Practices in the United States.
W91-06808 3A

Use of Membrane Technology in Florida.
W91-06809 3A

Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

Silting of Moroccan Dams.
W91-07065 2J

WATER RESOURCES MANAGEMENT
Isle of Wight Water Metering Trial.
W91-05966 3F

Network Management--the Bradford Experience.
W91-05967 5F

Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

Water Resource Planning in Canada.
W91-06230 6E

European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

Multicriterion Forest Watershed Resources Management.
W91-06569 6A

Management of Water Balance Components.
W91-06742 3F

Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

Economic Value of Wetlands-Based Recreation.
W91-06831 6B

Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

WATER REUSE
Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

Water Quality and Health.
W91-06060 5C

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

WATER SAMPLING
Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

WATER SHORTAGE
Perspective of Water Resources in Japan and in the World.
W91-06040 6D

WATER SOFTENING
Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

WATER STRESS
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

WATER SUPPLY
Isle of Wight Water Metering Trial.
W91-05966 3F

Network Management--the Bradford Experience.
W91-05967 5F

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

Development of Drinking Water Quality Surveillance in Malaysia.
W91-06065 5F

Tropical Source Water.
W91-06196 5F

Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

WATER SUPPLY DEVELOPMENT
Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

Desalting Practices in the United States.
W91-06808 3A

Use of Membrane Technology in Florida.
W91-06809 3A

WATER TABLE
Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

WATER TANKS
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

WATER TEMPERATURE
Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

WATER TREATMENT
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Performance and Analysis of Tracer Tests to Determine Compliance of a Disinfection Scheme with the SWTR.
W91-05965 5F

Water Treatment for Health Hazards.
W91-05977 5F

Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

Water Quality and Health.
W91-06060 5C

Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

Water Quality and Health (Review of the International Drinking Water Supply and Sanitation Decade).
W91-06064 5F

Development of Drinking Water Quality Surveillance in Malaysia.
W91-06065 5F

Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Drinking Water Microbiology: Progress and Recent Developments.
W91-06194 5F

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Tropical Source Water.
W91-06196 5F

Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

Microbiology of Activated Carbon.
W91-06199 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

Domestic Water Treatment for Developing Countries.
W91-06202 5F

Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Biofilms in Potable Water Distribution Systems.
W91-06206 5F

Waterborne Giardiasis.
W91-06207 5F

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Legionella in Drinking Water.
W91-06210 5A

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Viruses in Source and Drinking Water.
W91-06212 5F

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

Statistical Approaches to Monitoring.
W91-06214 5A

Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

Removing VOCs by Membrane Stripping.
W91-06814 5F

Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

Chlorination of Drinking Water and Cancer.
W91-06898 5F

WATER TREATMENT FACILITIES
Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

WATER USE
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

WATER USE EFFICIENCY
Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

Water Use and Average Growth Index of Five Species of Container Grown Woody Landscape Plants.
W91-06420 3F

WATER YIELD
Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

WATERFLEAS
Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

WATERSHED MANAGEMENT
River Catchment Planning for Land Drainage, Flood Defence and the Environment.
W91-05971 4A

Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

Historical and Present Day Management of the River Rhine.
W91-06051 5G

Forest Hydrology and Watershed Management.
W91-06510 4C

Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Management of Forests with Water Conservation Function.
W91-06554 4A

Dissolved Organic Carbon in Forested and Cut-over Drainage Basins, Westland, New Zealand.
W91-06555 4A

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

Multicriterion Forest Watershed Resources Management.
W91-06569 6A

Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

WATERSHEDS
Review on the Small Hydrological Basins in Finland.
W91-06463 2E

Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

WAVE DIRECTION
Sea Level Variability in Long Island Sound.
W91-06833 2L

WEAKFISH
Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

WEATHER DATA COLLECTIONS
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

WEATHER FORECASTING
Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

WEATHER PATTERNS
El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

WEATHERING
Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

WEED CONTROL
Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

WEEDS
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

WEIRS
Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

WELL CASINGS
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

WELL CONSTRUCTION
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

WELL PACKERS
Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

WELLS
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

WEST AFRICA
Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

WEST VALLEY DEMONSTRATION PROJECT
Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

WET DEPOSITION
Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

WETLANDS
Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

Economic Value of Wetlands-Based Recreation.
W91-06831 6B

Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

WHEAT
Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

WHEATGRASSES
Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

WHITE RIVER
Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

WILDLIFE CONSERVATION
Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

WILDLIFE HABITATS
Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

WILLAMETTE RIVER
Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

WILLOW TREES
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

WIND-DRIVEN CURRENTS
Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

WIND EROSION
Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

WIND WAVES
Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

WINDTHROW
Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

WISCONSIN
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

WOOD PRESERVATIVES
Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

WOODY DEBRIS
Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

WORKSHOPS
Erosion, Transport and Deposition Processes.
W91-06717 2J

WYOMING
Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

XANTHATE SLUDGE
Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

XIAMEN BAY
Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

YEASTS
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

YELLOW SEA
Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

YERSINIA
Yersinia enterocolitica in Drinking Water.
W91-06209 5F

ZEBRA FISH
Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

ZERO-ORDER BASINS
Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

ZIMBABWE
Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

ZINC
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

ZOOPLANKTON

Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

AUTHOR INDEX

AARSTAD, J. S.
Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

ABE, H.
Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

ABE, T.
Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

ABOU-SETTA, M. M.
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

ABOU-WALY, H.
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

ABRAHAMS, A. T.
Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

ACHESON, M. A.
Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

ACOSTA-RODRIGUEZ, J. L.
Optimal Spectral Base-Flow Estimation.
W91-07034 2E

ACREMAN, M.
Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

ACTON, D. F.
Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

ADAMS, C. E.
Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

ADAMS, J. R.
Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

ADAMS, S. M.
Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

ADAMSON, J. K.
Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

ADITYACHAUDHURY, N.
Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

ADLER, K. J.
Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

ADLER, M. J.
Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

AFOUDA, A.
Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

AHARONSON, N.
Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

AHMED, A. F. M.
Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

AIETA, E. M.
Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

AINSWORTH, R. G.
Water Treatment for Health Hazards.
W91-05977 5F

AJAO, E. A.
Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

AKIYAMA, M.
Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

AKIYAMA, R.
Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

AKSNES, D. L.
Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

AL-ANSARI, N. A.
Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

AL-BLOUSHI, A.
Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

AL-DAHAM, N. K.
Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

AL-KADI, B. T.
Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

AL-MUZAINI, S.
Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

AL-SINAWI, G. T.
Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

ALBERTS, E. E.
US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

ALBRIGHT, J. S.
Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

ALDAMA, A. A.
Optimal Spectral Base-Flow Estimation.
W91-07034 2E

ALDCORN, D.
Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

ALEGRE, J. C.
Soil Erosion Studies in Peru.
W91-06277 4D

ALEXANDER, D. J.
Managing Resources of the Murray-Darling Basin of Australia.
W91-06902 6B

ALEXANDER, M.
Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

ALGER, C. S.
Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

ALLEMAND, D.
Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

ALLEN, J. R. L.
Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

ALLEN, S. L.
Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

ALLENDER, W. J.
Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

ALONSO, C. V.
Sediment Losses from Cropland Furrows.
W91-07058 2J

ALURI, K.
Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

ALVA, A. K.
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

ALVAREZ-DEVESA, A.

ALVAREZ-DEVESA, A.
Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

ALVERA, B.
Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

AMANO, K.
Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

AMARO, K.
Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

AMBROISE, B.
Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

AMIEL, A. J.
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

AMIRTHANATHAN, G. E.
Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

AMSLER, M. L.
Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

ANDERSEN, R. A.
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

ANDERSEN, T.
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

ANDERSON, A. C.
Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

ANDERSON, C. A.
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

ANDERSON, D. P.
Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

ANDERSON, H.
Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

ANDERSON, L.
Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

ANDERSON, R. K.
Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

ANDERSSON, T.
Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

ANDREASSON, I. M.
Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

ANDREWS, M.
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

ANGELIDIS, M.
Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

ANIYA, M.
Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

ANKLEY, G. T.
Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

ANNIS, B.
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

ANTHONY, D. J.
Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

AOKI, S.
Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

APT, W. J.
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

ARAYA, T.
Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

ARIAS, G. S.
Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

ARNDT, J. L.
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

ARNELL, N.
Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

ARTHUR, M. F.
Sewage Sludge Application to Agricultural Land.
W91-06451 5E

ASAKAWA, Y.
Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

ASHENDEN, T. W.
Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

ASHMORE, P.
Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

ATTIA, Y. A.
Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

ATZEMA, A. J.
Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

AUERSWALD, K.
Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

AUGE, R. M.
Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

AUSTIN, M. P.
Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

AVIDOV, E.
Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

AYALA, G.
Flow in Damaged Pipe Networks.
W91-06296 8A

AZAM, J.
Applications of Remote Sensing Techniques for the Inventory and Monitoring of Environmental Pollution.
W91-07052 7B

BAATRUP, E.
Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

BABBITT, S.
Nutrient Needs.
W91-06398 3F

BABICH, H.
In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

BACH, H.
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

BAER, K. N.
Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

BAEZA, A.
Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

BAILEY, A. W.
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

BAKER, L. L.
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

BAKO, M. D.
Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

BALAKRISHNAN, N.
Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

BALDWIN, G.
Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

BALDWIN, K.
Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

BANDY, J. T.
Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

BANIEL, A. M.
New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

BANKS, P. A.
Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

BANUELOS, G. S.
Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

BARALE, R.
Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

BARBITTA, J.
Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

BARINAGA, C. J.
Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

BARKER, M. F.
Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

BARKER, P. R.
Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

BARKER, R.
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

BARKO, J. W.
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

BARLAS, M.
Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

BARNTHOUSE, L. W.
Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

BARO, P.
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

BARON VAN TUYLL VAN SEROOSKERKEN, E. H.
Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

BARRETT, W. M.
Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

BARTHOLOMEW, D. P.
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

BARUA, A. S.
Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

BASCANSA, P.
Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

BATES, E. R.
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

BATHURST, J. C.
Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

Critical Conditions for Bed Material Movement in Steep, Boulder-Bed Streams.
W91-06618 2J

BATTRAM, J. C.
Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

BAUER, L. R.
Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

BAUERLE, W. L.
Reduce Greenhouse Runoff.
W91-06403 3F

BAUMGARTNER, D. J.
Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

BAYNE, B. L.
Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

BEAMESDERFER, R. C.
Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

BEAN, B. W.
Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

BEARE, M. H.
Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

BEAUCHAMP, E. G.
Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

BEBIANNO, M. J.
Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

BECK, P.
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

BECKER, A.
Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

BECKER, D. S.
Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

BECKER, G.
Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

BECQUER, T.
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

BEDARD, Y.
Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

BEDI, H. S.
Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

BEHERNS, R. G.
Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

BEITINGER, T. L.
Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

BEL HADJ BRAHIM, A.
Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

BELL, S. A.
Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

BELLEN, G. E.
Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

BELLIN, C. A.
Sludge Organics Bioavailability.
W91-06449 5B

BENBI, D. K.
Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

BENDA, L.
Sediment Routing by Debris Flow.
W91-06594 2J

BENDER, M. E.
Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

BENEDEK, P.
Water Quality and Health (Review of the International Drinking Water Supply and Sanitation Decade).
W91-06064 5F

BENGTSON, R. L.
USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

BENNETT, D. R.
Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

BENNETT, G. F.
Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

BENSON, D. L.
Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

BENSON, W. H.
Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

BENZING, T. M.
Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

BERG, N. H.
Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

BERGSTROM, J. C.
Economic Value of Wetlands-Based Recreation.
W91-06831 6B

BERGSTROM, L. R.
Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

BERGSTROM, W. R.
Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

BERKEL, J.
Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

BERMEJO-MARTINEZ, F.
Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

BERRY, J. B.
Minimizing Waste by Charging the Generator.
W91-06161 5E

BERTRAND, J. C.
Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

BESSER, J. M.
Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

BETTOLI, P. W.
Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

BEVAN, D. R.
Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

BHARATH, A.
Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

BHATTACHARYA, S. K.
Chlorination of Drinking Water and Cancer.
W91-06898 5F

BHOLE, A. G.
Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

BHOWMIK, N. G.
Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

BICKHAM, J. W.
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

BICKNER, F. R.
Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

BILLON, A.
Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

BIONDINI, M. E.
Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

BIRK, W. M.
Drownproofing of Low Overflow Structures.
W91-06294 8B

BIRKLAND, J.
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

BISCHOFSBERGER, W.
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

BISHOP, P.
Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

BITTER, P.
Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

BJORNSTAD, H. E.
Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

BLACK, D.
Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

BLAIR, J. B.
Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

BLAIR, J. M.
Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposi-

tion and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

BLAKAR, I.
NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

BLASDEL, J. E.
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

BLEDSOE, L. J.
Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

BLIDARU, S.
Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

BLINN, D. W.
Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

BLOCK, J. C.
Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

BOARDMAN, G. D.
Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

BODY, D. N.
Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

BOEHMER, A. M.
Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

BOEWONO, D. T.
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

BOGAARDS, R. H.
Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

BOGEN, J.
Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

BOGGS, R. C.
Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

BOHM, J.
Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

BOISSON, F.
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

BOKUNIEWICZ, H.
Groundwater Seepage along a Barrier Island.
W91-06954 2F

BOLIN, S. B.
Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

BOLTERO, J. Y.
Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

BONELL, M.
Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

BONIN, P.
Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

BORAZJANI, H.
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

BORDAS, M. P.
Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

BORENFREUND, E.
In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

BORGES, A. L. O.
Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

BORLAKOGLU, J.
Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

BORN, S. M.
Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

BORUP, M. B.
Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

BOSCH, D. J.
Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

BOSTIAN, K. A.
Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

BOSTICK, W. D.
Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

BOTTOM, D. L.
Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

BOUDOT, J.-P.
Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

BOURGES, J.
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

BOUTEN, W.
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

BOUWER, H.
Linkages with Ground Water.
W91-06743 2F

BOVIS, M. J.
Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

BOWEN, T.
Surface Charge on Wastewater Sludges.
W91-06439 5D

BOWERS, J. E.
William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

BOYLEN, C. W.
Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

BRADAT, M.
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

BRADBURY, S. P.
Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

BRADLEY, B. P.
Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

BRADLEY, J. B.
Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

BRADLEY, P. M.
Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

BRADLEY, S. B.
Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

BRAITHWAITE, A.
Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

BRANDT, J.
Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

BRANHAM, B. E.
Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

BRAS, R. L.
Model of River Basin Evolution.
W91-07026 2J

BREE, T.
Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

BREMER, P. J.
Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

BRETSCHKO, G.
Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

BRICKA, R. M.
Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

BRICKELL, J.
Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

BRICQUET, J. P.
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

BRIDGES, D. C.
Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

BRINGI, V. N.
Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

BROADBENT, F. E.
Proper Accounting for N in Cropping Systems.
W91-06737 3F

BRONSWIJK, J. J. B.
Shrinkage of Dutch Clay Soil Aggregates.
W91-06935 2G

BROSELISKE, G. H.
Historical and Present Day Management of the River Rhine.
W91-06051 5G

BROWN, M. W.
Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

BROWN, S. J.
Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

BRUCE, R. D.
Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

BRUENING, R. L.
Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

BRUNE, D. E.
Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

BRUNEAU, P.
Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

BRUNER, K. A.
Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

BRUNO, M. S.
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

BRYAN, G. W.
Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

BRYAN, R. B.
Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

BUCHANAN, G.
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

BUCHMAN, M. F.
Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

BUCKE, D.
Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

BUCKLEY, L. P.
Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

BUDARAJU, S.
Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

BUDDENHAGEN, I. W.
Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

BUFFLE, J.
In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

BUHL, K. J.
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

BULL, R. A.
Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

BUNKELMANN, J. R.
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

BUNTON, T. E.
Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

BURGESS, D.
Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

BURKE, J. S.
Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

BURNETT, W. C.
Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

BURNS, S. F.
Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

BUROS, O. K.
Desalting Practices in the United States.
W91-06808 3A

BURT, G. R.
Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

BURT, T. P.
Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

BURTON, W. D. S.
Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

BUTCHER, D. P.
Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

BUTLER, M. G.
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

BUTTEL, L. A.
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

CADLE, S. H.
Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

CAI, J.
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

CAIRNS, J.
Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

CAIRNS, V. W.
Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

CALABRESE, E. J.
Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

CALLAHAN, J. L.
Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

CALLE, H.
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

CALVER, A.
Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

CAMBON, J. P.
Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

CAMP, J.
Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

CAMPBELL, A. G.
Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

CAMPBELL, B. L.
Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

CAMPBELL, G. M.
Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

CAMPBELL, J.
Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

CAMPESAN, G.
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

CANNON, J. N.
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

CANTERAS, J. C.
Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

CANTON, S. P.
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

CANTOR, K. P.
Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

CAPONE, D. G.
Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

CAPRIO, J. M.
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

CAPUZZO, J. M.
Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

CARBERRY, J. B.
Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

CARGO, D. G.
Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

CARLING, P. A.
Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

CARLSON, R. W.
Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

CARNEVALE, M. A.
Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

CARNS, K. E.
Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

CARRIERE, S.
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

CARSON, D. B.
Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

CARTER, V.
Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

CARTWRIGHT, P. S.
Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

CARVALHO, N. O.
Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

CASTILLA, J. C.
High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

CASTRANTAS, H. M.
UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

CASWELL, E. P.
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

CATALLO, W. J.
Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

CELIK, I.
Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

CERMAK, J.
Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

CESARE, M. A.
First-Order Analysis of Open-Channel Flow.
W91-06297 8B

CHAMBERS, E. G.
Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

CHAMBERS, R. O.
Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

CHANASYK, D. S.
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

CHANDRASEKAR, V.
Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

CHANG, A. C.
Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

CHANG, C.
Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

CHANG, K. C. K.
Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

CHANG, T.
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

CHAPMAN, E. G.
Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

CHARACKLIS, W. G.
Biofilms in Potable Water Distribution Systems.
W91-06206 5F

CHARANIA, S. H.
Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

CHAROENSUK, S.
Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

CHASE, G. G.
Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

CHAUDHURI, C.
Domestic Water Treatment for Developing Countries.
W91-06202 5F

CHAUDHURI, S.
Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

CHAUHAN, S. P.
Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

CHAWLA, R.
Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

CHAWLA, R. C.
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

CHEN, J.
Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

CHEN, J. Y.
Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

CHEN, R. H.
Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

CHEN, S.
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

CHEN, Y. X.
Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

CHEN, Z.
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

CHENG, J. D.
Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

CHENG, K.
Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

CHENG, K. S.
Thin Cake Filtration: Theory and Practice.
W91-06425 5D

CHENG, T. C.
Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

CHERGUI, H.
Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

CHEUNG, W. H. S.
Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

CHIAVERIN, J.
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

CHILDERS, D. L.
Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

CHILDS, S. W.
Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

CHILTON, E. W.
Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

CHO, K. S.
Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

CHOI, C. C.
Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

CHONG, R.
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

CHOWDHURY, A.
Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

CHOWDHURY, T.
Spreading of Oil Spilled Under Ice.
W91-07029 5B

CHRISTOFFERSEN, K.
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

CIAIO, C. J.
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

CLARK, G. A.
Measurement of Soil Water Potential.
W91-06415 2G

CLARK, J. A.
Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

CLARK, M. J.
Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

CLARK, M. M.
Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

CLARK, R. M.
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

CLARKE, C.
Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

CLARKE, D.
Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

CLARKSON, C. R.
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

CLAY, S. A.
Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

CLELAND, D. R.
Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

CLEMENT, R. L.
Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

CLIFFORD, C. H.
Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

CLOTHIER, W. D.
Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

CLOUD, G. L.
Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

CODLING, E. E.
Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

COFER, C. K.
Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

COGOLLO, P. R. J.
Mathematical Model for Reservoir Silting.
W91-07062 2J

COHEN, G. B.
Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

COIMBRA, A. R. S. R.
Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

COLEMAN, R.
Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

COLLADO, J.
Optimal Spectral Base-Flow Estimation.
W91-07034 2E

COLOMBO, P.
Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

COMBES, F.
Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

CONLEY, L. F.
Legionella in Drinking Water.
W91-06210 5A

CONLON, W. J.
Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

Use of Membrane Technology in Florida.
W91-06809 3A

COOHILL, L. M.
Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

COOK, B. G.
Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

COOK, G. P.
Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

COOK, P. W.
Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

COOLEY, R. L.
Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

CORAPCIOGLU, M. Y.
Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

CORBIN, F. T.
Transformation of Alachlor by Microbial Communities.
W91-06829 7B

CORDERY, S. A.
Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

CORMIER, S. M.
Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

CORNABY, B. W.
Sewage Sludge Application to Agricultural Land.
W91-06451 5E

CORWIN, D. L.
Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

COSTA, F.
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

COSTA, J.
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

COSTELLO, C.
Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

COUTANT, C. C.
Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

COVA, D.
Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

COWART, J. B.
Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

COWGILL, U. M.
Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

CRAIG, A. C.
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

CRANE, A. J.
Acid Rain.
W91-06236 5B

CRAVEDI, J. P.
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

CRAWFORD, M. A.
Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

CRAWFORD, P. M.
Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

CREAGER, J. S.
Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

CREED, I. R.
Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

CRETNEY, W. J.
Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

CRIPE, C. R.
Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

CROSS, W. H.
Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

CROTZER, M. E.
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

CROWDER, R. E.
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

CROWTHER, J. M.
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

CRYER, A.
Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

CUENCA, G.
Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

CUMMINGS, E. W.
Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

CUMMINGS, L. E.
Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

CUNDY, T. W.
Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

CUNNANE, C.
Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

CUNZHI, Z.
Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

CURRAN, J.
Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

CURRAN, J. C.
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

CUSTER, T. W.
Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

D'AQUINO, M.
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

DA COSTA, M. S.
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

DAGG, B. R.
Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

DAI, S.
Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

DALTON, D.
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

DANIELS, C. B.
Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

DANIELS, T. G.
Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

DARROW, P. O.
Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

DASCH, J. M.
Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

DAUTREBANDE, S.
Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

DAUVIN, J. C.
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

DAVID, M. B.
Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

DAVIDSON, D. H.
Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

DAVIS, E. C.
Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

DAVIS, J. C.
Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

DAVIS, L. S.
Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

DAVIS, M. R.
Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

DAWSON, B. R.
Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

DAWSON, D. A.
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

DAY, A. J.
Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

DAY, J. W.
Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

DAY, K. E.
Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

DAY, S. R.
Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

DAY, T. J.
Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

DE ABREU SA, L. D.
Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

DE BAEZ, C. C.
Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

DE BEN, W. A.
Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

DE BUSTAMANTE, I.
Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

DE DATTA, S. K.
Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

DE DEUS, C. E.
Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

DE GROOT, A. J.
Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

DE GROOT, G. J.
Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

DE JONG, E.
Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

DE JONG, J.
Historical and Present Day Management of the River Rhine.
W91-06051 5G

DE LUCA, S. J.
Rain and Urban Stormwater Quality.
W91-06053 5B

DE O, A. L.
Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

DE RENZIS, D.
Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

DE VITRE, R. R.
In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

DE ZWART, A.
Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

DEANGELIS, D. L.
Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

DEARING, J. A.
Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

DEBRY, A.
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

DEETAE, S.
Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

DEFOUW, T. H.
Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

DEFRANK, J.
Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

DEGENHARDT, D.
Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

DELGADO, M.
Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

DELMAS, P.
Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

DEMISSIE, M.
Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

DEMUTH, S.
Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

DEN BESTEN, P. J.
Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

DENCE, C. W.
Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

DENGLER, L.
Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

DENICOLA, D. M.
Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

DENT, C. B.
Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

DESAI, S.
Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

DESCHAMPS, R. J. A.
Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

DETENBECK, N. E.
Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

DEXTER, A. R.
Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

DHAMALA, B. R.
Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

DHILLON, G. S.
Vortex-Settling Basin Design Considerations.
W91-06292 8B

DI SIMPLICIO, P.
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

DIALLO, M. S.
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

DIAZ, R. J.
Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

DICKSIN, R. L.
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

DICKSON, E. L.
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

DIETER, C. D.
Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

DIETRICH, A. M.
Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

DIETRICH, W. E.
Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

DIETRICH, W. E.

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

DIEZ, J.-C.
Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

DILLON, T. M.
Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

DINNEL, P. A.
Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

DITSWORTH, G.R.
Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

DIXON, O. W.
Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

DIXON, P. F.
Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

DOBSON, R.
Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

DOE, K.
Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

DOERGE, D. R.
Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

DOERING, P. H.
Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

DOLAN, J. F.
Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

DOLCI, F.
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

DOLMAN, A. J.
Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

DONAHUE, B. A.
Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

DONALD, A. P.
Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

DONATO, A.
Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

DOOLITTLE, J.
Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

DOPHEIDE, J. C. R.
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

DOVING, K. B.
Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

DOYLE, R. D.
Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

DRABKIN, M.
Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

DRAGO, E. C.
Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

DRAGOI, E.
Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

DRAI, P.
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

DRISCOLL, C. T.
Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

DU, R.
Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

DU, Y.
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

DUBREUIL, P.
European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

DUBREUIL, P. L.
From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

DUCKSTEIN, L.
Multicriterion Forest Watershed Resources Management.
W91-06569 6A

DUEDALL, I. W.
Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

DUKE, H. R.
Management of Water Balance Components.
W91-06742 3F

DUMBLE, J. P.
Above-Ground Landfill: The Engineered Approach.
W91-05969 5E

DUNNE, T.
Sediment Routing by Debris Flow.
W91-06594 2J

DUPUIS, W. S.
Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

DURANCEAU, S. J.
Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

DURGA PRASAD, Y. V. K.
Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

DUTRIEUX, E.
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

DUYSINGS, J. J. H. M.
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

DYE, B. A.
Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

DYE, P. J.
Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

DYKES, G. M.
Use of Membrane Technology in Florida.
W91-06809 3A

EADIE, B. J.
Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

EBDON, L.
Development of a Novel Multi-Element Detection System for Trace Metal Determination

Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

EBISE, S.
Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

EBISEMIJU, F. S.
Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

ECKERT, W.
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

EDSALL, C. C.
Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

EDWARDS, C. J.
Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

EELES, C. W. O.
Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

EFIRD, P.
Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

EICEMAN, G. A.
Sludge Organics Bioavailability.
W91-06449 5B

EL-KORCHI, T.
Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

EL-SABH, M. I.
Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

EL-SHAARAWI, A. H.
Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

ELLEN, S. D.
Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

ELLIOTT, G. L.
Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

ELMUBARAK, A. H.
Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

ELSKUS, A. A.
Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

EMTIAZI, G.
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

ENDO, T.
Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

ENFIELD, C.
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

ENGELEN, G. B.
ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

ENGLERT, J. P.
Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

ENTZ, T.
Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

ERGENZINGER, P.
Nature of Coarse Material Bed Load Transport.
W91-07080 2J

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

ERICHSEN, B.
Regional Hydrology: Applications of Information Technology.
W91-06508 2E

ERICKSON, R. J.
Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

ERIKSEN, K. D. H.
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

ERNST, W. R.
Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

ESSERY, C.
Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

ESTES, M. K.
Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

ESTRADA, M.
Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

EVANS-BROWN, B.
Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

EVANS, D. O.
Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

EVANS, M. S.
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

EVANS, R. D.
Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

EVERS-VERMEER, J. J.
Shrinkage of Dutch Clay Soil Aggregates.
W91-06935 2G

EYAL, A. M.
New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

EZELL, D.
Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

FAGADE, O.
Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

FAISON, B. D.
Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

FAITH, D. P.
Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

FANCEY, L.
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

FANCEY, L. F.
Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

FANG, D.
Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

FARMANFARMAIAN, A.
Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

FARRELL, A. P.
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

FARRELL, E. P.
Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

FARRINGTON, J. W.
Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

FATTAH, Q. N.
Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

FAUST, W. R.
Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

FAYAD, N. M.
Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

FEDERER, C. A.
Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

FEDERICI, B. A.
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

FEDEROV, S. F.
Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

FEIST, S. W.
Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

FELIPE-MORALES, C.
Soil Erosion Studies in Peru.
W91-06277 4D

FELLER, M. C.
Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

FELSENFELD, A. J.
Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

FENG, J. C.
Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

FENG, Y. J.
Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

FENT, K.
Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

FERERES, E.
Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

FERGUSON, B. J.
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

FERGUSON, B. K.
Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

FERGUSON, R.
Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

FERNANDES, N. F.
Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

FERNANDEZ, J. V.
Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

FERNANDEZ, M. A.
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

FEROZ, M.
Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

FERRARI, L.
Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

FERRARO, S. P.
Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

FERRIER, R. C.
Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

FIELD, R. J.
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

FINCHAM, S.
Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

FINDLEY, J. S.
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

FINDLEY, M. W.
Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

FINE, P.
Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

FISCHER, H. B.
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

FISHER, S. W.
Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

FITZGERALD, J. W.
Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

FLACKE, W.
Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

FLATAU, G. N.
Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

FLEET, B.
Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

FLEISHER, J. M.
Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

FLEMING, R. W.
Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

FLEMING, W. M.
Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

FLINT, A. L.
Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

FLODERUS, S.
Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

FLORES-BAEZ, B. P.
DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

FLORSHEIM, J. L.
Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

FOCARDI, S.
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Her-

ring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

FOGEL, M.
Multicriterion Forest Watershed Resources Management.
W91-06569 6A

FOLLET, R. F.
Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

FOLMAR, L. C.
Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

FOREMAN, K.
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

FOROPOULOS, J.
Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

FORSLUND, B. L.
Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

FORTEZA, V.
Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

FOSSATO, V. U.
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

FOSSI, C.
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

FOSTER, I. D. L.
Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

FOX, G. A.
New Strategies for Great Lakes Toxicology.
W91-06926 5A

FOX, R. H.
Estimation of N Budgets for Crops.
W91-06739 3F

FRAGA, F.
Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

FRANKENBERG, E. W.
Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

FRANZ, E.-M.
Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

FREDERICKS, D. J.
Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

FREDETTE, T. J.
Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

FREEMAN, H.
Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

FREIRIA-GANDARA, M. J.
Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

FRENCH, M. C.
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

FRERICHS, N.
Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

FREY, B. E.
Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

FRICK, N. H.
Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

FRIETAG, D.
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

FRIMMEL, F.
Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

FRIMMEL, F. H.
Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

FRITSCH, J. M.
From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

FRITZ, B.
Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

FROMM, C. H.
Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

FRUHLICH, W.
Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

FRY, D. M.
Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

FRYE, W. W.
Fertilizer Nitrogen Management.
W91-06738 3F

FU, S. Y.
Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

FUESLER, T. P.
Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

FUHRMANN, M.
Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

FUJIE, K.
Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

FUJINO, K.
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

FUJITA, K.
Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

FUJITA, T.
Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

FUKAI, S.
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

FUKUSHIMA, T.
Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

FUKUSHIMA, Y.
Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

FUKUZONO, T.
Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

FULTON, L. J.
Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

FUSCO, R.
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

GADEL, F.
Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

GADJEV, G. K.
General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

GAINES, A. G.
Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

GALA, W. R.
Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

GALAR, I.
Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

GALE, R. J.
Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

GALINDO-BECT, M. S.
DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

GALLART, F.
Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

GALM, J. R.
Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

GANTZER, C. J.
Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

GAO, S.
Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

GARCIA, C.
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

GARCIA, E. P.
Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

GARCIA, L. A.
Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

GARDINER, J. L.
River Catchment Planning for Land Drainage, Flood Defence and the Environment.
W91-05971 4A

GARDNER, G. R.
Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

GARDNER, R. L.
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

GARDNER, T. J.
Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

GARG, A.
DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

GARRETSON, C.
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

GARRETT, G. S.
Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

GARRETT, J. H.
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

GARVEY, J. S.
Metallothionein: A Potential Biomonitor of Exposure to Environmental Toxins.
W91-06188 5A

GASCUEL-ODOUX, C.
Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

GAUSSOIN, R. E.
Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

GAUTHIER, M. J.
Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

GAVASKAR, A. R.
Sewage Sludge Application to Agricultural Land.
W91-06451 5E

GBUR, E. E.
Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

GEALY, D. M.
Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

GELDREICH, E. E.
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

Home Treatment Devices and Water Quality.
W91-06201 5F

Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

GELWICK, F. P.
Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

GENSEMER, R. W.
Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

GENTIL, F.
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

GEORGE, S.
Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

GEORGE, W. J.
Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

GERBA, C. P.
Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

Viruses in Source and Drinking Water.
W91-06212 5F

GERBER, B. L.
Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

GERMANOSKI, D.
Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

GERSHEY, E. L.
Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

GHOSH, M. M.
Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

GIAM, C. S.
Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

GIBBONS, J. W.
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

GIBBS, P. E.
Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

GIBBS, R. A.
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

GIBILISCO, R. D.
UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

GIBLIN, A. E.
Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

GIBSON, T.
Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

GIESE, B. S.
Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

GIESY, J. P.
Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

GILBERTSON, M.
New Strategies for Great Lakes Toxicology.
W91-06926 5A

GILEWICZ, M.
Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

GILL, T. S.
Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

GILLIAM, T. M.
Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

GILLINS, R. L.
Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

GILLMAN, E. F.
Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

GILMOUR, E.
Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

GIPPEL, C. J.
Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

GISH, J. W.
Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

GITAU, F. K.
Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

GLASS, J.
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

GLEDHILL, W. E.
Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

GLIWICZ, Z. M.
Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

GLOYNA, E.
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

GNASSIA-BARELLI, M.
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

GODA, T.
Management and Status of Japanese Public Waters.
W91-06039 5G

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

GODOY, F. E.
Minimizing Waste Oil Disposal.
W91-06168 5E

GODOY, J. M.
Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

GOETZ, A. J.
Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

GOH, K. S.
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

GOKCAY, C. F.
Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

GOKSOYR, A.
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

GOLDING, D. L.
Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

GOMES, H. P.
Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

GONZALEZ, M. J.
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

GOODEN, D. T.
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

GOODRICH, J. A.
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

GOODRICH, M.
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

GORGE, G.
Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

GORTER, A. C.
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

GOTO, I.
Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

GOTO, M.
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

GOTTSCHALK, L.
Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

GOULD, J. P.
Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

GOVERS, G.
Empirical Relationships for the Transport Capacity of Overland Flow.
W91-06720 2J

GOVIND, R.
Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

GOYAL, M. R.
Class A Pan Evaporation versus Potential Evapotranspiration at Seven Locations in Puerto Rico.
W91-06419 2D

GRABOW, W. O. K.
Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

GRACIA-SANCHEZ, J.
Suspended Sediment Routing along a Reservoir.
W91-07070 2J

GRADY, C. P. L.
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

GRAETZ, D. A.
Water Hyacinth Growth in Anaerobic Digester Effluents.
W91-06222 5D

GRAF, J. B.
Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

GRAS, F.
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

GRASHOFF, C.
Effect of Pattern of Water Supply on Vicia faba L.: 1. Dry Matter Partitioning and Yield Variability.
W91-06932 3F

Effect of Pattern of Water Supply on Vicia Faba L.: 2. Pod Retention and Filling, and Dry Matter Partitioning, Production and Water Use.
W91-06934 3F

GRAY, J. S.
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

GREELEY, M. S.
Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

GREEN, R. E.
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

GREENBERG, A.
Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

GREENE, L. A.
Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

GREEVES, J.
Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

GRESS, D.
Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

GREW, R.
Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

GRIMANIS, A. P.
Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

GROFFMAN, P. M.
Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

GROSS, R.
Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

GROSSMAN, E.
Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

GROTENHUIS, J. T.
Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

GRUBER, G. W.
Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

GRUNEWALD, U.
Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

GUANSHAN, L.
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

GUIDICELLI, J.
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

GUIMARAES, J. R. D.
Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

GUIN, J. A.
Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

GUO, Q.
Surging in Urban Storm Drainage Systems.
W91-07033 5D

GUPTA, C. P.
Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

GUPTA, G.
Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

GUPTA, R. C.
Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

GURIJALA, K. R.
Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

GURNELL, A. M.
Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

GUSTAFSON, D. A.
Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

GUSTAFSON, D. E.
Ten-Minute Digestion.
W91-06429 5D

GUSTARD, A.
Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

GUYOT, J. L.
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

HAAS, C. N.
Statistical Approaches to Monitoring.
W91-06214 5A

HABIBI, M. H.
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

HADISUWASONO,
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

HAGANS, D. K.
Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

HAGE, F. J.
Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

HAGSTROM, J. P.
Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

HAHN, M. E.
Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

HAIGH, M. J.
Evolution of an Anthropogenic Desert Gully System.
W91-06721 2J

HAINES, G. B.
Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

HAINLY, R. A.
Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

HALBIRT, C. D.
Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

HALE, R. C.
Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

HALEY, J. L.
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

HALEY, M. V.
Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

HALL, J. C.
Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

HALLBERG, G. R.
Nitrate in Ground Water in the United States.
W91-06734 5B

HAMADA, M.
Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

HAMILTON, P.
Historical Changes in the Columbia River Estuary.
W91-06288 2L

Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

HAMILTON, S. J.
Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tshawytscha).
W91-06000 5C

HAMODA, M.
Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

HAMPEL, H. J.
Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

HANAFEY, M. K.
Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

HANCOCK, C. M.
Waterborne Giardiasis.
W91-06207 5F

HANLEY, N.
Economics of Nitrate Pollution.
W91-06790 5C

HANNAK, P.
Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

HANSEN, J. C.
Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

HANSEN, L. R.
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

HANSON, B.
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

HANSON, M. A.
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

HANSSON, T.
Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

HARA, Y.
Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

HARADA, H.
Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

HARAGUCHI, H.
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

HARAKEH, S.
Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

HARGIS, W. J.
Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

HARGROVE, W. L.
Cropping Systems: Ecology and Management.
W91-06741 3F

HARITONIDIS, S.
Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

HARMON, W. C.
Sediment Losses from Cropland Furrows.
W91-07058 2J

HARRINGTON, D. W.
Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

HARRISON, D. S.
Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

HARRISON, P. J.
Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

HARRISON, R. B.
Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

HARVEY, J. W.
Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

HARVEY, M. D.
Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

HARVEY, R. B.
Historical Changes in the Columbia River Estuary.
W91-06288 2L

HARVEY, R. G.
Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

HASHOLT, B.
Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

HATTORI, S.
Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

HATTORI, T.
Determination of Soluble Selenium in Soils.
W91-06970 5A

HAUX, C.
Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

HAVAS, M.
Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

HAWKINS, A. J. S.
Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

HAWKINS, C. P.
Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

HAYASAKA, S. S.
Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

HAYES, D. C.
Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

HAYES, J.
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

HAYWARD, G.
Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

HAZEN, T. C.
Tropical Source Water.
W91-06196 5F

HEAKAL, M. S.
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

HEEDE, B. H.
Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

HEERMANN, D. F.
Management of Water Balance Components.
W91-06742 3F

HEGGENES, J.
NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

HEISER, J. H.
Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

HELBIG, A.
Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

HELD, L. J.
Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

HELLER, B.
Statistical Approaches to Monitoring.
W91-06214 5A

HEMPEL, D. C.
Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

HEMPHILL, D. D.
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

HENDERSON, B. A.
Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

HENDERSON, T. K.
Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

HENNIGAR, P.
Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

HENRY, C. B.
Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

HENRY, M.
New Strategies for Great Lakes Toxicology.
W91-06926 5A

HENRY, T. R.
Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

HENZE, M.
Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

HEO, W. M.
Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

HERDENDORF, C. E.
Great Lakes Estuaries.
W91-06846 2H

HERMENS, J. L. M.
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

HERNANDEZ, J.
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

HERNANDEZ, L. M.
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

HERNANDEZ, T.
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

HERON, R.
Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

HERRERA, R.
Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

HERRICKS, E. E.
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

HERRMANN, A.
Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

HERWIG, H. J.
Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

HESSE, L. W.
Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

HETHERINGTON, E. D.
Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

HEWITT, C. N.
Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

HEWITT, J. E.
Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

HIBLER, C. P.
Waterborne Giardiasis.
W91-06207 5F

HICKEY, M.
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

HIGASHI, S.
Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

HIGLEY, D. L.
Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

HILL, D. O.
Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

HINCHEE, R. E.
Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

HINTON, D. E.
Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Environmental Contamination and Cancer in Fish.
W91-06378 5C

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

HIRAI, M.
Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

HIRSCHHORN, J. S.
Waste Reduction Audits: Matching Types to Stages.
W91-06162 5E

HO, G. E.
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

HO, K. C.
Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

HOAGLAND, K. D.
Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

HODGMAN, W.
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

HODSON, P. V.
Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

HOEDE, D.
Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

HOEGLER, J. M.
Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

HOERNSTROEM, E.
Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

HOFFMAN, G. J.
Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

HOFFMANN, J. P.
Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

HOGAN, D. L.
Influence of Large Organic Debris on Channel Recovery in the Queen Charlotte Islands, British Columbia, Canada.
W91-06621 4C

HOGSTRAND, C.
Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

HOKE, H.
Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

HOLDA, I.
Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

HOLIDAY, T. L.
Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

HOLLAND, R. S.
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

HOLLINGWORTH, R. M.
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

HOLLY, F. M.
Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

HOLMES, J. T.
Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

HOLWERDA, D. A.
Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

HOMAN, F. J.
Minimizing Waste by Charging the Generator.
W91-06161 5E

HONG, H.
Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

HOORELBECKE, R.
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

HORAN, N. J.
Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

HORNBECK, J. W.
Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

HORNUNG, M.
Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

HOSKING, J. K.
Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

HOSSAIN, M. A.
Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

HOUSE, M. A.
River Basin Management in the UK.
W91-06045 6E

HOWES, B.
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

HOWES, D. E.
Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

HRISSANTHOU, V.
Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

HRUDEY, S. E.
Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

HSIA, Y. J.
Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

HU, M.
Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

HU, M. H.
Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

HU, S.
Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

HUANG, C. P.
Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

HUANG, S.
Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

HUANG, Y.
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

HUANG, Y. P.
Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

HUBBARD, K. G.
Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

HUBBS, C. W.
Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

HUBER, L. J.
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

HUCKINS, J. N.
Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

HUGGETT, R. J.
Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

HUGGINS, A.
Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

HUGHES, B.
Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

HUH, C. A.
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

HUHTA, V.
Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

HUMMEL, H.
Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

HUMMERSTONE, L. G.
Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

HUMPHREYS, G. S.
Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

HUNG, R. P. S.
Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

HUPP, C. R.
Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

HURYN, A. D.
Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

HUSAINI, Y.
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

HUSOY, A.-M.
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

HUSSAIN, A. M. Z.
Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

HUTIRA, J.
Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

HYLKO, J. M.
Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

ICHIM, I.
Relationship Between Sediment Delivery Ratio and Stream Order: a Romanian Case Study.
W91-06722 2J

IDE, C. N.
Rain and Urban Stormwater Quality.
W91-06053 5B

IDRIS, H.
Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

IMADA, N.
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

IMAI, H.
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

INBAR, M.
Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

INGERSOLL, C. G.
Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

INOUE, K.
Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

INOUE, T.
Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

IRONS, L. A.
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

ISAAC, G. A.
Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

ISHERWOOD, R.
Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

ISHIBASHI, T.
Perspective of Water Resources in Japan and in the World.
W91-06040 6D

ISHIDA, H.
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

ISHII, D.
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

ISHIWATARI, R.
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

ISOLDA, A.
Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

IVANOVA, N. A.
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

IZATT, R. M.
Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

JACANGELO, J. G.
Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

JACKIM, E.
Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

JACKSON, K. A.
Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

JACKSON, R. E.
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

JACKSON, R. J.
Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

JACKSON, T. L.
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

JACKSON, W. L.
Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

JACOBS, A. F. G.
Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

JACOBS, J. J.
Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

JACOBSEN, B.
Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

JACOBSON, D. N.
Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

JAGANNADH, S. V.
Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

JAMES, E. J.
Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

JAMES, S. C.
Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

JAMES, W. F.
Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

JANICKI, A. J.
Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

JANZ, D. M.
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

JAPENGA, J.
Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

JARRELL, W. M.
Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

JAY, D. A.
Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

JAYAWARDENA, A. W.
Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

JENNINGS, B. R.
Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

JENSEN, J. N.
Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

JENSEN, T. L.
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

JERNLAS, R.
Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

JEWELL, C. S.
Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

JEWELL, C. S. E.
Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

JIANLU, Z.
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

JIAXIN, J.
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

JIMENEZ, B. D.
Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

JIRASUKTAVEEKUL, W.
Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

JIRJIS, B. F.
Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

JIYE, Z.
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

JOAO, R. V.
Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

JOBST, H.
Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

JOHN, D. M.
Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

JOHNSON, C. W.
Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

JOHNSON, D. W.
Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

JOHNSON, H. W.
Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

JOHNSON, J. H.
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

JOHNSON, L. R.
Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition

JOHNSON, L. R.

and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

JOHNSON, R. C.
Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

JOHNSTON, C. A.
Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

JOHNSTON, G. O.
Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

JOHNSTON, P.
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

JONAH, P.
Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

JONES, A. J.
Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

JONES, G. N.
Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

JONES, H. G.
Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

JONES, J. W.
Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

JONES, K. K.
Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

JONES, O. R.
Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

JONES, P.
Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

JONES, T. D.
Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

JONES, T. L.
Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

JORGENSEN, G. H.
Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

JOSHI, S. B.
Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

JOSLIN, J. D.
Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

JOUSTRA, K. D.
Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

JOYE, D. D.
New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

JUERGENS-GSCHWIND, S.
Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

JULIEN, G.
Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

JUN, Y.
Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

JUNGLING, T.
Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

JURY, W. A.
Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

JUSTUS, T. A.
Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

KAARTVEDT, S.
Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

KACZMARSKY, M. M.
Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

KALAJIAN, E. H.
Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

KALINAUSKAS, R.
Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

KAMINSKI, J.
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

KAMPE, W.
Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

KANG, J. H.
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

KANG, Z.
Erosion Processes and Effects of Debris Flow.
W91-06596 2J

KANNAN, K.
Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

KANOH, M.
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

KAPATOV, A. A.
Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

KAPATOVA, N. I.
Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

KAPOOR, A. K.
Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

KAPOTOV, A. A.
Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

KARAM, A. M.
Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

KATAN, J.
Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

KATO, T. R.
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

KATOU, H.
Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

KATTELMANN, R.
Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

KAUFMANN, P. R.
Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

KAURI, T.
Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

KAUSHIK, N. K.
Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

KAWAMURA, M.
Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

KAY, B. D.
Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

KAY, D.
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

KAY, J.
Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

KEENER, T. C.
Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

KEENEY, D. R.
Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Sources of Nitrate to Ground Water.
W91-06733 5B

KEINATH, T.
Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

KELLER, E. A.
Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

KELLS, J. J.
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

KELLY, J. R.
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

KELSCH, S. W.
Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

KELSEY, H. M.
Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

KEMP, A. C.
Towards a Dynamic Model of Gully Growth.
W91-06725 2J

KENDALL, R. J.
Sentinel Species and Sentinel Bioassay.
W91-06190 5A

KENNEDY, R. C.
Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

KENT, M.
Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

KERTESZ, A.
Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

KHAN, A. A.
Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

KHAN, M. A. Q.
Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

KHAN, R. A.
Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

KHUNJI, Z. A.
Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

KICENIUK, J.
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

KIDWELL, M.
Land and Liquid Disposal Bans.
W91-06679 5E

KIEFFER, R. J.
Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

KIEMNEC, G. L.
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

KIM, B. C.
Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

KIM, Y. H.
Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

KIMURA, I.
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

KIMURA, M.
Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

KINAE, N.
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

KING, D. R.
Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

KING, K. A.
Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

KING, L. W.
Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

KIRBY, K. W.
Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

KIRKBY, M.
Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

KISSEL, J. C.
Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

KISSELBURG, J. E.
Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

KJERFVE, B.
Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

KJOLLER, A.
Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

KLEEVENS, J. W. L.
Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

KLEIN, R.
Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

KLINGEMAN, P. C.
Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

KLUNGSOYR, J.
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

KLYSNER, A.
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

KNEIB, R. T.
Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

KNOWLES, C. R.
Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

KNOX, G. W.
Water Use and Average Growth Index of Five Species of Container Grown Woody Landscape Plants.
W91-06420 3F

KOBASHI, S.
Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

KOBAYASHI, K.
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

KOCAN, R. M.
Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

KOCH, B.
Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

KOEHLER, A.
Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

KOH, C. C.
Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

KOHMA, M.
Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

KOHRING, G.-W.
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

KOJIMA, M.
Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

KOLL, J.
Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

KOLOVOPOULOS, P.
Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

KOLVITES, B.
Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

KONDOLF, G. M.
Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

KONDRATIEV, S. A.
Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

KOONCE, J. F.
Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

KORKKA-NIEMI, K.
Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

KOSKINEN, W. C.
Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

KOSTECKI, P. T.
Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

KOUTITONSKY, V. G.
Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

KOZIE, K. D.
Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

KRAEMER, T. F.
Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

KRAMER, V. I.
Laboratory Evaluation of Lagenidium giganteum (Oomycetes: Lagenidiales) in Water from Contra Costa County, California, Mosquito Sources.
W91-06122 5G

KRASOVSSKAIA, I.
Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

KRAUSE, R.
Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

KRCA, S.
DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

KRECMER, V.
Management of Forests with Water Conservation Function.
W91-06554 4A

KREISEL, W.
Water Quality and Health.
W91-06060 5C

KREZOSKI, S.
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

KRISHNAMURTHY, S.
Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

KRISHNAMURTI, T. N.
Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

KROENING, H.
Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

KROKLI, B.
Low Flow Analysis.
W91-06505 2E

KSZOS, L. A.
Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

KUBO, T.
Recent Developments in Wastewater Management in Japan.
W91-06041 5G

KUBOTA, H.
Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

KUCERA, J.
Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

KUCHTA, J. M.
Legionella in Drinking Water.
W91-06210 5A

KUDO, A.
Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

KUDOH, S.
Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

KUMAI, H.
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

KUNIANSKY, E. L.
Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

KURELEC, B.
DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

KUROKI, T.
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

KURY, F. L.
Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

KUSK, K.
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

KUWATSUKA, S.
Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

KWAISER, T.
Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

KWANMING, C.
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

LA MORI, P. N.
In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

LA POINT, T. W.
Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

LA TORRE, B.
Soil Erosion Studies in Peru.
W91-06277 4D

LA VEN, R. D.
Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

LACEWELL, R. D.
Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

LAFLEN, J. M.
US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

LAGREGA, M. D.
Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

LAHA, S.
Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

LAHLOU, A.
Silting of Moroccan Dams.
W91-07065 2J

LAIKARI, H.
Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

LAINE, J.-M.
Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

LAIRD, J.
Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

LAL, R.
Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

LALONDE, R. T.
Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

LAMB, T.
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

LANCASTER, B. A.
Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

LANDIS, W. G.
Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

LANDOLT, R. R.
Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

LANDRUM, P. F.
Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

LANE, L. J.
Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

LANG, G. E.
Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

LANGAN, S. J.
Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

LANGSTON, W. J.
Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

LANNA, A. E.
Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

LANTZ, R. C.
In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

LAPOINTE, B. E.
Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

LARA-LARA, J. R.
Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

LARSEN, H. E.
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

LARSEN, M. M.
Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

LAUREN, D. J.
In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

LAUT, P.
Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

LAVABRE, J.
Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

LAVEE, H.
Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

LAVY, T. L.
Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

LAW, R. J.
Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

LAWRENCE, E. G.
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

LEAITCH, W. R.
Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

LEAVER, M.
Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

LEAVITT, R. A.
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

LECHEVALLIER, M. W.
Microbiology of Activated Carbon.
W91-06199 5F

LEE, H.
Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

LEE, H. J.
Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

LEE, L. K.
Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

LEE, R. F.
Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

LEE, S. W.
Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

LEE, Y. D.
Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

LEHRE, A. K.
Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

LEIGHTON, J.
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

LEMAIRE, P.
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

LENNON, G. P.
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

LEONARD, G. H.
Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

LEONZIO, C.
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

LEPISTO, A.
Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

LEPPAJARVI, R.
Frequency Analysis of Flood and Low Flow.
W91-06504 2E

LEPRUN, J. C.
Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

LESAGE, S.
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

LEUTHEUSSER, H. J.
Drownproofing of Low Overflow Structures.
W91-06294 8B

LEVINE, S. N.
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

LEVNO, A. B.
Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

LEVY, R. V.
Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

LEWIS, M. A.
Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

LEWIS, R. H.
Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

LI, J.
Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

Erosion Processes and Effects of Debris Flow.
W91-06596 2J

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

LI, W.
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

LIANG, S. L.
Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

LIANWU, Y.
Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

LIE, U.
Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

LIENKAEMPER, G. W.
Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

LIGGETT, J. A.
Computation (Investigation, Education, and Application).
W91-07027 8B

Flow in Damaged Pipe Networks.
W91-06296 8A

LILJESTRAND, H. M.
Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

LILLIE, R. A.
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

LIN, B.
Study of the Total Load Transport by the Yellow River.
W91-07108 2J

LIN, J.
Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

LIN, M.
Ecological Studies on the Hydromedusae, Siphonophores and Ctenophores in the Xiamen Harbor and Adjacent Waters.
W91-06106 2L

LIN, Y. L.
Erosional Effects of Road Construction in Pi-Lu Experimental Watershed.
W91-06608 2J

LINDER, G.
Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

LINDSTROM-SEPPA, P.
Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

LININS, I.
Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

LION, L. W.
Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

LISLE, T. E.
Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

LITERATHY, P.
Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

LITHNER, G.
Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

LITTLE, E. E.
Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

LIU, C. M.
Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

LIU, V. C.
Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

LIU, V. T.
Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

LIU, Z.
Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

LIVANOVA, N. A.
Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

LIVINGSTON, D. R.
Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

LIVINGSTONE, D. R.
Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

LLERENA, C. A.
Erosion and Sedimentation Issues in Peru.
W91-06571 2J

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

LOEHR, R. C.
Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

LOGAN, T. J.
Sludge Metal Bioavailability.
W91-06448 5B

LOGSDON, G. S.
Microbiology and Drinking Water Filtration.
W91-06200 5F

LOMBARDO, R. J.
Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

LONG, E. R.
Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

LONG, Y.
Study of the Total Load Transport by the Yellow River.
W91-07108 2J

LOPATA, V. J.
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

LOPES, V. L.
Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

LORD, M. L.
Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

LORENZO-FERREIRA, R. A.
Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

LOUGHRAN, R. J.
Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

LOUTIT, M. W.
Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

LOWATANATRAKUL, W.
Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

LOWELL, T. V.
Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

LOWENBERG, H.
Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

LOWER, W. R.
Sentinel Species and Sentinel Bioassay.
W91-06190 5A

LOWRANCE, R. R.
Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

LU, H. S.
Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

LUBOWITZ, H. R.
Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

LUDLOW, M. M.
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

LUDWIG, J. P.
New Strategies for Great Lakes Toxicology.
W91-06926 5A

LUGTHART, G. J.
Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

LUK, S.-H.
Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

LUM, W. K.
Development of Drinking Water Quality Surveillance in Malaysia.
W91-06065 5F

LUMADJENG, H. S.
Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

LUTHY, R. G.
Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

LYDERSEN, E.
Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

LYDY, M. J.
Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

LYMAN, R. L.
Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

LYNCH, C. F.
Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

MAACK, L.
Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

MACCONNELL, G. S.
Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

MACDONALD, A.
Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

MACDONALD, K. B.
Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

MACDONALD, L. H.
Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

MACDONALD, R. W.
Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

MACKAY, D.
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

MADEJ, M. A.
Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

MAGARITZ, M.
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

MAGETTE, W. L.
Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

MAGLEBY, R. S.
Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

MAHARA, Y.
Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

MAHDYOUN, F.
Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

MAHONEY, R. F.
Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

MAJOR, M. A.
Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

MAKELA, P .
Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

MAKEYEVA, V. I.
Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

MALEA, P.
Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

MALLARD, C.
Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

MALLEVIALLE, J.
Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

MALLORY, L. L.
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

MAMBANI, B.
Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

MANAIA, C. M.
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

MANDERSON, G. J.
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

MANDRACCHIA, M. A.
Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

MANVILLE, J. F.
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

MANZI, A. O.
Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

MANZOORI, J. L
Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

MARCUS, J. M.
Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

MARSHALL, T. R.
Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

MARTEL, C. J.
Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

MARTIKAINEN, E.
Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

MARTIN, A. R.
Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

MARTIN-ALGUACIL, N.
In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

MARTIN, F.
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

MARTIN, J. E.
Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

MARTIN, J. F.
Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

MARTIN, R. J.
Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

MARTINEZ, J. O.
Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

MARTINEZ, P. G.
Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

MARTINEZ-TABCHE, L.
Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

MARTINEZ TABERNER, A.
Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

MARTINSON, R. J.
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

MARUNICH, S. V.
Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

MASHHADY, A. S.
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

MASTEN, R. A.
Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

MASTERS, J. A.
Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

MASUD, S. M.
Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

MATANMI, B. A.
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

MATHERINE, A. M.
Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

MATHEW, K.
Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

MATHEWS, E. S.
Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

MATHIEU, A.
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

MATIN, A.
Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

MATSUDA, K.
Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

MATSUMURA, F.
Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

MATTHEWS, W. J.
Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

MATTHEWS, W. V. G.
Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

MATTUS, A. J.
Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

MAUL, A.
Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

MAY, M. L.
Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

MAYER, E.
Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

MAYERNIK, J. A.
Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

MAYERS, J.
Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

MCALLISTER, P. J.
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

MCCARTHY, J. F.
Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

MCCARTHY, J. J.
Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

MCCAULEY, R. W.
Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

MCCLELLAN, S. A.
Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

MCCLURE, T.
Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

MCCOLL, J. G.
Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

MCCUSKEY, P. A.
In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

MCCUSKEY, R. S.
In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

MCDANIEL, P. A.
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

MCDERMOTT, M. R.
Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

MCDIFFETT, W. F.
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

MCDONALD, A.
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

MCDONNEL, J. W.
Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

MCDOUGALL, B. K.
Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

MCDOWELL, S.
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

MCELFISH, J. M.
Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

MCELROY, A. E.
Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

MCFARLAND, L. K.
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

MCFETERS, G. A.
Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Microbiology of Activated Carbon.
W91-06199 5F

MCGIBBON, A. S.
Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

MCGINNIS, G. D.
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

MCGURK, B. J.
Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

MCINTIRE, C. D.
Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

MCINTYRE, P. F.
Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

MCISAAC, G. F.
Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

MCKIM, J. M.
Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

MCMAHON, G.
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

MCMANAMON, J. T.
Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

MCMILLAN, T.
Water Resource Planning in Canada.
W91-06230 6E

MCPHERSON, B. F.
Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

MEADOR, J. P.
Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

MEANS, J. C.
Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

MEDEIROS, P.
Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

MEDICI, F.
Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

MEDINA, E.
Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

MEEK, D. W.
Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

MEEKS, G.
Growth Management: A Renewed Agenda for States.
W91-06227 6B

MEGAHAN, W. F.
Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

MEHRLING, P.
Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

MEIJER, H. A.
State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

MEINEL, W.
Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

MEISCH, M. V.
Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

MELCER, H.
Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

MELVIN, W.
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

MENARD, F.
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

MENENDEZ, M.
HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

MENETTO, A.
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

MERKS, A. G. A.
Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

MERLET, D.
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

MERLI, C.
Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

MERSEREAU, R. C.
Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

MESTL, G. E.
Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

METCALF, T. G.
Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

METCALFE, P. J.
Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

METWALLY, A. I.
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

MEUNIER, M.
Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

MEW, G.
Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

MEYER, D. F.
Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

MEYER, L. D.
Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

Sediment Losses from Cropland Furrows.
W91-07058 2J

MHAISALKAR, V. A.
Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

MIDDLEDITCH, B. S.
Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

MIELKE, L. N.
Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

MIGLIORE, L.
Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

MIKLANEK, P.
Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

MIKULA, R.
Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

MILANO, L. B.
Rain and Urban Stormwater Quality.
W91-06053 5B

MILAZZO, D. P.
Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

MILES, C. J.
Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

MILLE, G.
Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

MILLER, D. E.
Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

MILLER, J. D.
Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

MILLER, M.
Project Management.
W91-06848 6A

MILLER, M. R.
Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

MILLER, R. L.
Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

MILLER, S. F.
Making the Most of Bottoms and Residuals.
W91-06688 5D

MILNE, D. P.
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

MINEMATSU, H.
Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

MIRO, C.
Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

MISSELBROOK, T. H.
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

MISTRY, J. F.
Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

MITCHELL, M. J.
Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

MITEMA, E. S.
Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

MIWA, N.
Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

MIYAHARA, S.
Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

MIYAKE, T.
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

MIYAZAKI, A.
Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

MIYAZAWA, M.
Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

MIYOSHI, T.
Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

MIZRAHI, J.
New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

MIZUHARA, K.
Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

MIZUTANI, T.
Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

MIZUYAMA, T.
Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

MLADENOVSKI, C.
Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

MOCHIZUKI, S.
Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

MODAIHSH, A. S.
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

MOGK, D. W.
Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

MOKADEM, A.
Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

MOLINARI, G. P.
Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

MOLNAR, L.
Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

MONTAGNE, C.
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

MONTEITH, H.
Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

MONTGOMERY, D.
Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

MOORE, D. W.
Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

MOORE, J. A.
Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

MOORE, M. J.
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

MOORE, R. B.
Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

MOORE, T. R.
Dissolved Organic Carbon in Forested and Cut-over Drainage Basins, Westland, New Zealand.
W91-06555 4A

MOORHEAD, K. K.
Water Hyacinth Growth in Anaerobic Digester Effluents.
W91-06222 5D

MORAIS, P. V.
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

MOREL, G.
Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

MORENO, A.
Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

MORETTON, J.
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

MORGAN, J. D.
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

MORRIS, C. D.
Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

MORRIS, J. T.
Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

MORT, M. A.
Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

MORTON, J. A.
Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

MORTON, R. D.
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

MOTTA, J. O.
Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

MOUDGIL, B. M.
Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

MOUSAVIPOUR, F.
Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

MOYA, G.
Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

MOYO, N. A. G.
Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

MUELLER, S. F.
Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

MUELLER, T. C.
Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

MULAWA, P. A.
Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

MULFORD, L. A.
Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

MULLA, M. S.
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

MULLEN, J. F.
Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

MULLIGAN, F. S.
Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

MUNAF, E.
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

MUNIZ, I. P.
Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

MUNOZ-PARDO, J.
Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

MUNTISOV, M.
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

MURA, R.
Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

MURAKAMI, K.
River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

MURALIDHARA, H. S.
Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

MURAOKA, K.
Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

MURAYAMA, S.
Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

MURPHY, J. A.
Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

MURRAY, D. S.
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

MUSIAGER, A. O.
Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

MUSKO, I. B.
Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

NACCI, D.
Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

NAETH, M. A.
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

NAFF, R. L.
Techniques of Water-Resources Investigations of the United States Geological Survey. Chapter B4: Regression Modeling of Ground-Water Flow.
W91-07044 2F

NAGATA, O.
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

NAGEL, R.
Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

NAKAGAWA, H.
Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

NAKAMURA, F.
Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

NAKAMURA, M.
Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

NAKANISHI, H.
Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

NAKASUGI, O.
Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

NALIM, S.
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

NARBAITZ, R. M.
Removing VOCs by Membrane Stripping.
W91-06814 5F

NASCI, C.
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

NASSER, A. M.
Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

NAVARRO, E.
Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

NAVAS, A.
Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

NAYAK, I. V.
Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

NAZAROVA, Y. V.
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

NEAL, C.
Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

NEAL, W. J.
Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

NEILL, W. H.
Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

NELSON, M. K.
Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

NELSON, W. G.
Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

NEPSZY, S. J.
Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

NETTO, A. L. C.
Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

NEUFANG, L.
Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

NEUHAUSER, E. F.
Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

NEUWIRTH, M.
Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

NEWSOME, C. D.
Network Management--the Bradford Experience.
W91-05967 5F

NGUYEN, V. D.
Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

NICHOLLS, S.
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

NICKELSEN, M. G.
Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

NICOLAE, T.
Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

NICOLAIDOU, A.
Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

NICOLSON, J. A.
Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

NIELSEN, D. R.
Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

NIELSEN, G. A.
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

NIEMI, G. J.
Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

NIEUWENHUIZE, J.
Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

NIGG, H. N.
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

NIIMI, A. J.
Review of Biochemical Methods and Other Indicators to Assess Fish Health in Aquatic Ecosystems Containing Toxic Chemicals.
W91-06920 5A

NILLES, M. A.
Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

NIMMO, I.
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

NIMMO, W. B.
Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

NISHIMURA, K.
Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

NISHIMURA, M.
Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

NOBLE, D. T.
Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

NOBLE, R. L.
Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

NOGUCHI, G. E.
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

NOLAN, K. M.
Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

NOMINE, J. C.
Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

NOMURA, J.
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

NOREY, C. G.
Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

NORRIS, V.
Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

NORTON, R. A.
Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

NOTT, J. A.
Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

NOUH, M.
Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

NOUR, S.
Present Groundwater Status in Egypt and the Environmental Impacts.
W91-06798 2F

NOVAK, V.
Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

NOWICKA, B.
Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

NUNES, O. C.
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

NUTT, S. G.
Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

NWEKE, A.
Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

NYER, E. K.
Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

NYHOLM, N.
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

NYSSEN, G. A.
Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

O'BARA, C. J.
Current Distribution and Status of the Upper Cumberland River Johnny Darter, Etheostoma nigrum susanae.
W91-06019 2H

O'CONNELL, J. D.
Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

O'CONNOR, G. A.
Sludge Organics Bioavailability.
W91-06449 5B

O'GORMAN, T.
Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

O'HARA, S.
Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

O'KEEFFE, J.
Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

O'LOUGHLIN, C. L.
Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

O'NEILL, M. J.
Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

OANCEA, V.
Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

OBERDORFER, J. A.
Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

OBERLE, S. L.
Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

OBLATH, S. B.
Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

OBLISAMI, G.
Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

ODUM, W. E.
Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

OFFUTT, S.
Agriculture's Role in Protecting Water Quality.
W91-06305 5G

OGATA, S.
Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

OHNO, T.
Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

OHNO, Y.
Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

OHTE, K.
Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

OIKARI, A.
Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

OIKARI, A. O. J.
Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

OJO, O.
Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

OKAGBUE, C. O.
Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

OKAJIMA, H.
Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

OKUDA, S.
Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

OKUNISHI, K.
Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

OLANREWAJU, D.
Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

OLDENBURG, K. U.
Waste Reduction Audits: Matching Types to Stages.
W91-06162 5E

OLIVE, L. J.
Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

OLIVER, J.
Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

OLIVRY, J. C.
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

OLOFIN, E. A.
Dynamics of Gully Head Recession in a Savanna Environment.
W91-06726 2J

OMURA, H.
Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

ONG, S. K.
Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

ONGERTH, J. E.
Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

ONO, Y.
Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

OOSTERHOF, D. K.
Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

ORCIARI, R. D.
Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

OREND, K.
Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

ORME, A. R.
Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

ORMEROD, S. J.
Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

OROZCO, J. G.
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

ORR, D.
Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

ORSBORN, J. F.
New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

ORTH, R. J.
Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

OSAKI, S.
Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

OSBORN, C. T.
Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

OSBORNE, P. E.
Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

OSGOOD, M. P.
Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

OSGOOD, T. B.
Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

OSHIMA, Y.
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

OSRODKA, L.
Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

OSTERMANN, M.
Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

OSTFELDT, P.
Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

OTTO, R. G.
Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

OUCHI, S.
Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

OVIATT, C. A.
Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

OWEN, B. A.
Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

OWOADE, A.
Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

OYEGUN, C. U.
Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

OZAKI, V. L.
Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

OZRETICH, R. J.
Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

PACHECO, J. E.
Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

PACHEPSKIY, Y. A.
Effect of the Composition of Soil Solutions and Exchange Cations on Water Retention and Hydraulic Conductivity.
W91-05980 2G

PACKHAM, R. F.
Chemical Aspects of Water Quality and Health.
W91-05976 5F

PAGE, A. L.
Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

PAGES, J.
Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

PAIN, B. F.
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

PAINE, A. D. M.
Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

PAL, R.
Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

PALMER, R.
Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

PANDE, J.
Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

PANDURANGA RAO, D.
Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

PANGARO, N.
Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

PARAMASIVAM, R.
Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

PAREKH, B. K.
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

PARK, Y. A.
Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

PARKER, G.
Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

PARKER, R. S.
Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

PARKIN, T. B.
Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

PARMELEE, R. W.
Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

PARRISH, J.
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

PARSONS, A. J.
Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

PART, P.
Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

PARVIN, M. R.
Network Management--the Bradford Experience.
W91-05967 5F

PASCOE, D.
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

PASTOROK, R. A.
Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

PATCHARAPREECHA, P.
Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

PATTEE, E.
Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

PAUL, T. C.
Vortex-Settling Basin Design Considerations.
W91-06292 8B

PAULEY, G. B.
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

PAUW, J. P.
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

PAVIGNANO, S.
Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

PAVLICIK, V.
Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

PAVLIK, B.
Groundwater Seepage along a Barrier Island.
W91-06954 2F

PAYNE, J. F.
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melanomacrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

PAYNE, N. J.
Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

PEARCE, A. J.
Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

PEART, M. R.
Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

PEDERSEN, B.
Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

PEIQUAN, L.
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

PENUELAS, J.
HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

PEPSON, D.
Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

PERAKYLAN, H.
Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

PERDU-DURAND, E.
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

PEREIRA, J. C. A.
Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

PEREZ, L.
Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

PERINA, V.
Management of Forests with Water Conservation Function.
W91-06554 4A

PERRENS, S. J.
Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

PERRY, R.
Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

PESONEN, M.
Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

PETERING, D. H.
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

PETERS, E. J.
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

PETERS, N. E.
Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

PETERS, R. W.
Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

PETERSON, C. G.
Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

PETERSON, G. A.
Fertilizer Nitrogen Management.
W91-06738 3F

PETTERSSON, L. E.
Flood-Calculations in Norway.
W91-06502 2E

PEYTON, G. R.
Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

PHILLIPS, B. R.
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

PHILLIPS, D. J. H.
Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

PHILLIPS, J. M.
Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

PHILLIPS, R. E.
Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

PICQUELLE, S. J.
Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

PIERCE, R. S.
Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

PIGG, J.
Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

PIHL, L.
Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

PILKEY, O. H.
Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

PILSON, M. E. Q.
Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

PIONKE, H. B.
Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

PIPES, W. O.
Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

PIRES DO RIO, M. A.
Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

PIRT, J.
Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

PITLICK, J.
Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

PLANCHON, O.
Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

PLUGGE, C. M.
Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

PLUMB JR, R. H.
Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

PODOWSKI, A. A.
Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

POESEN, J. W. A.
Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

POHLAND, F. G.
Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

POLARSKI, M.
Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

POLEO, A. B. S.
Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

POMERLEAU, N. M.
Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

PONGBOON, K.
Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

PONTASCH, K. W.
Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

POON, C. S.
Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

POONIA, S. R.
Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

POPE, D. J.
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

POREMBA, K.
New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

PORTER, E. L.
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

PORZUCEK, C.
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

POSA, D.
3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

POULSEN, O.
Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

POWELL, D. B.
Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

POWELL, S. J.
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

POWER, J. F.
Proper Accounting for N in Cropping Systems.
W91-06737 3F

PRADEEPKUMAR, P. K.
Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

PRADO-FIEDLER, R.
Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

PRATT, J. R.
Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

PREGO, R.
Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

PRESTEGAARD, K. L.
Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

PRIDDLE, M.
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

PRIDMORE, R. D.
Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

PRITCHARD, P. H.
Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

PROBST, A.
Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

PROBSTEIN, R. F.
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

PRUELL, R. J.
Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

PRUESS, K. P.
Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

PUGH, J. R.
Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

PUGLIESE, K. A.
Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

PUIGDEFABREGAS, J.
Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

PUROHIT, M. U.
Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

PUTJAROON, W.
Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

QUINN, J. S.
Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

RACINE, R. N.
Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

RADCZUK, L.
Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

RAHMAN, A.
Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

RAHMAN, M. A.
Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

RAI, L. C.
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

RAINBOW, P. S.
Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

RAJ, M.
Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

RAJENDRAN, N.
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

RAM BHASKAR, B.
Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

RAMANATHAN, A.
Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

RAMBELOARISOA, E.
Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

RAMON, G.
Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

RAMSAY, W. J. H.
Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

RAMUNDO, R. A.
Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

RANATUNGA, R. P. J.
Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

RANDOLPH, E. R.
Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

RANGANA, G.
Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

RANKL, J. G.
Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

RANTAMAKI, P.
Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

RAO BHAMIDIMARRI, S. M.
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

RAPPORT, D. J.
Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

RATOVSKIY, G. V.
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

RAVEN, K. G.
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

RAVI, T. B.
Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

REALEY, G. J.
Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

REASH, R. J.
Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

REASONER, D. J.
Home Treatment Devices and Water Quality.
W91-06201 5F

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

REDDY, K. R.
Water Hyacinth Growth in Anaerobic Digester Effluents.
W91-06222 5D

REDIG, K. A.
Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

REDULLA, C. A.
Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

REES, Y. J.
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

REGISTER, A. E.
Waste Minimization Liability Issues.
W91-06680 5G

REINESKOG, M.
Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

REINHART, D. R.
Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

REINISCH, C. L.
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

RENAUD, P. C.
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

RENEAU, C. J.
Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

RENEAU, S. L.
Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

RESCH, M. E.
Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

RETTINGER, S.
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

REYES, M. L.
Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

REYNOLDS, B.
Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

REYNOLDS, P. E.
Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

RHOADES, J. D.
Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

RHOTON, F. E.
Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

RIBEIRO, L. O.
Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

RICCI, G. A.
Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

RICE, C. P.
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

RICE, C. T .
Indoor Soil Erosion Research Facility.
W91-06232 2J

RICE, D. W.
Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

RICHARDSON, J. L.
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

RICHTER, G.
Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

RIEGER, W. A.
Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

RIEMAN, B. E.
Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

RIEMANN, B.
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

RIFFLE, M. S.
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

RILEY, C. M.
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

RINGHAND, H. P.
Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

RINNE, J. N.
Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

RIOS, A. F.
Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

RISSMANN, E.
Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

RITTER, D. F.
Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

RITTER, L. E.
Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

RITTMANN, B. E.
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

RIVERS, R.
Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

ROALD, L. A.
Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

ROBERTS, C. J.
Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

ROBERTS, M. A.
Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

ROBINSON, A. Y.
Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

ROBINSON, J. M.
Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

ROBINSON, M.
Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

ROBSON, J. N.
Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

ROCA, J. P.
Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

ROCHE, M. A.
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

RODEAN, H. C.
Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

RODELSPERGER, M.
Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

RODI, W.
Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

RODRIGUEZ-ITURBE, I.
Model of River Basin Evolution.
W91-07026 2J

RODZEWICH, E. A.
Source Reduction--Parts Cleaning.
W91-06682 5E

ROECK, D. R.
Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

ROETH, F. W.
Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

ROETHAL, F. J.
Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

ROFF, J. C.
Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

ROGERS, D. V.
Isle of Wight Water Metering Trial.
W91-05966 3F

ROGERS, R. D.
Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

ROHMANN, U.
Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

ROHRKE, M. J.
Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

ROJARAYANONT, S.
Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

ROMEO, M.
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

ROMPAS, R. M.
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

RONEN, D.
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

RONIS, M. J. J.
Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

ROPER, D. S.
Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

ROQUERO, C.
Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

ROSE, J. B.
Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

Viruses in Source and Drinking Water.
W91-06212 5F

ROSENBERG, D. W.
In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

ROSENBLATT, D. H.
Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

ROSENFELD, J. K.
Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

ROSS, B. B.
Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

ROSS, B. D.
Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

ROSSE, M.
3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

ROSSINI, L.
Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

ROTHWELL, R. L.
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

ROTIVAL, A. H.
Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

ROUILLER, J.
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

ROUYSUNGNERN, S.
Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

ROWLAND, S. J.
Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

RUBER, E.
Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

RUBIN, A. J.
Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

RUDNICK, D. T.
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

RUELLE, P.
Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

RUSHBROOK, P. E.
Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

RUSIN, J.
Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

RUSSELL, R. W.
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

RUSSELLE, M. P.
Cropping Systems: Ecology and Management.
W91-06741 3F

RUTT, G. P.
Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

RYAN, J. A.
Sludge Organics Bioavailability.
W91-06449 5B

RYAN, P.
Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

RYAN, P. E.
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

RYBICKI, N. B.
Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

RYDER, R. A.
Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

RYON, M. G.
Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

SABATER, S.
Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

SABBAGH, G.
USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

SAEGER, V. W.
Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

SAENGKOOVONG, P.
Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

SAFLEY, L. M.
Psychrophilic Anaerobic Digestion of Animal Manure: Proposed Design Methodology.
W91-06225 5D

SAHA, J.
Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

SAID, M. A.
Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

SAITO, T.
Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

SAKAMOTO, M.
Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

SAKHUJA, V. S.
Vortex-Settling Basin Design Considerations.
W91-06292 8B

SAKUMA, T.
Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

SALBU, B.
Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

SALEM, N.
Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

SALOMONS, W.
Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

SALTVEIT, S. J.
NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

SALVESEN, R. H.
On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

SAMHAN, O.
Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

SAMS, T. L.
Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

SANDIFORD, P.
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

SANEOKA, H.
Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

SANTAMARIA, J. M.
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

SANTMARTI, M.
Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

SANTRY, D. C.
Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

SARRAILH, J. M.
From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

SATOH, F.
Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

SATTAR, S. A.
Domestic Water Treatment for Developing Countries.
W91-06202 5F

SAVAGE, M. H.
Minimizing Waste Oil Disposal.
W91-06168 5E

SAYAL, S. K.
Vortex-Settling Basin Design Considerations.
W91-06292 8B

SCARPATO, R.
Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

SCHAEFER, C. H.
Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

SCHEPERS, J. S.
Estimation of N Budgets for Crops.
W91-06739 3F

SCHERTZ, D. L.
US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

SCHEUNERT, I.
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

SCHIEMANN, D. A.
Yersinia enterocolitica in Drinking Water.
W91-06209 5F

SCHIPHOLT, I. J. L.
Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

SCHLUCHTER, M. D.
Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

SCHMIDT, J. C.
Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona.
W91-07041 2J

SCHNEIDER, R. C.
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

SCHOEN, G.
Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

SCHOHL, G. A.
Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

SCHONIGER, M.
Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

SCHROBILTGEN, P.
Oxygen Transfer in Trickling Filters.
W91-06864 5D

SCHRODER, H. F.
Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

SCHROEDER, P. R.
Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

SCHROEDER, W. H.
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

SCHULER, P. F.
Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

SCHULTZ, T. W.
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

SCHULZE, R. E.
Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

SCHUMM, S. A.
Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

SCHWARZE, R.
Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

SCOCCIA, G.
Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

SCOTT, C. D.
Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

SCOTT, G. I.
Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

SCOTT, W. E.
Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

SCULLY, F. E.
Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

SEASTEDT, T. R.
Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

SEDELL, J. R.
Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

SEECH, A. G.
Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

SEIGLE-MURANDI, F.
Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

SEINEN, W.
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

SEITZ, W. R.
Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

SEKINE, M.
Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

SELLEY, R. A.
Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

SEMMELMANN, F. R.
Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

SEMMENS, M. J.
Removing VOCs by Membrane Stripping.
W91-06814 5F

SENAPATI, N.
Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

SENENT, F.
Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

SENFTLE, F. E.
Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

SERYSHEV, V. A.
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

SERYSHEVA, N. V.
Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

SETALA, H.
Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

SETAREH, M.
Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

SEUNA, P.
Review on the Small Hydrological Basins in Finland.
W91-06463 2E

SHANABLEH, A.
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

SHANNON, R. D.
Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

SHAPIRO, A. P.
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

SHARIATPANAHI, M.
Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

SHARMA, M. L.
Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

SHAW, M. D.
Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

SHEETS, T. J.
Transformation of Alachlor by Microbial Communities.
W91-06829 7B

SHEKTER SMITH, L. J.
Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

SHELDON, R.
Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

SHELDON, S. P.
Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

SHEPARD, K. L.
Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

SHERIFF, T. S.
Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

SHERWOOD, C.
Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

SHERWOOD, C. R.
Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

SHI, W.
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

SHIEH, C. S.
Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

SHIMIZU, Y.
Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

SHIRMOHAMMADI, A.
Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

SHIU, W. Y.
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

SHIVELY, W. E.
Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

SHODA, M.
Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

SHOEMAKER, J. L.
Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

SHOEMAKER, L. L.
Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

SHORT, D.
Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

SHORT, D. A.
Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

SHUGART, L. R.
Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Biological Monitoring: Testing for Genotoxicity.
W91-06183 5A

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

SIDLE, R. C.
Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

SIGHA, N.
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

SIKKA, H. C.
Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

SIKONIA, W. G.
Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

SILLMAN, D. Y.
Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

SILVA FILHO, V. D. P.
Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

SILVA, I. G.
Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

SIMENSTAD, C. A.
Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Historical Changes in the Columbia River Estuary.
W91-06288 2L

SIMKISS, K.
Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

SIMON, A.
Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

SIMPSON, M. G.
Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

SINCLAIR, N. A.
Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

SINGER, P. C.
Performance and Analysis of Tracer Tests to Determine Compliance of a Disinfection Scheme with the SWTR.
W91-05965 5F

SINGH, A.
Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

SINGH, A. K.
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

SINGH, H.
Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

SINGH, M.
Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

SINGH, R. P.
Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

SISSON, J. D.
Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

SKAGGS, R. L.
Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

SKEFFINGTON, R. A.
Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

SKELLY, D. K.
Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

SKIPPER, H. D.
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

SKURDAL, J.
NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

SLATER, J. M.
Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

SMAAL, A. C.
Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

SMALL, L. F.
Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

SMELTZER, E. E.
Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

SMIT, H.
Historical and Present Day Management of the River Rhine.
W91-06051 5G

SMITH, A. D.
Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

SMITH, A. L.
Isle of Wight Water Metering Trial.
W91-05966 3F

SMITH, F. J.
Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

SMITH, J. D.
Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

SMITH, K.
Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

SMITH, L. B.
Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

SMITH, L. M.
Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

SMITH, M. S.
Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

SMITH, N. J. H.
Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

SMITH, R. D.
Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

SMITH, S. V.
Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

SMOLEN, M. J.
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

SMOLOWITZ, R.
Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

SMOLOWITZ, R. M.
Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

SNEL, M.
Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

SNYDER, R. D.
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

SOCZYNSKA, U.
Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

SOLCH, J. G.
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

SOLLARS, C. J.
Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

SOLMAN, K.
Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

SOLOMON, K. R.
Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

SOMIYA, I.
Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

SOMLYODY, L.
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

SOMMERFELDT, T. G.
Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

SONG, C. C. S.
Surging in Urban Storm Drainage Systems.
W91-07033 5D

SONNEVIL, R.
Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

SONZOGNI, W.
Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

SONZOGNI, W. C.
Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

SORENSEN, H. B.
Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

SOSKOLNE, C. L.
Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

SOUTHWORTH, G. R.
Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

SPARLING, G. P.
Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

SPECHT, D. T.
Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

SPENCE, R. D.
In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

SPIEKER, R.
New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

SPIES, R. B.
Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

SPRADLIN, C. N.
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

SPRINGER, T.
Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

SPRINGGATE, M. E.
Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

SPROULE, J. W.
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

SRINIVASA RAO, K.
Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

SRINIVASAN, V. S.
Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

SRIVASTAVA, R. C.
Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

STABLES, T. B.
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

STAM, A. C.
Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

STAMS, A. J.
Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

STAMS, A. J. M.
Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

STANA, R. R.
Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

STANCZYK, T. F.
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

STANEV, E. V.
Mechanisms of the Black Sea Circulation.
W91-06410 2B

STANKIEWICZ, M.
Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

STATES, S. J.
Legionella in Drinking Water.
W91-06210 5A

STEDNICK, J. D.
Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

STEGEMAN, J. J.
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

STEIMAN, R.
Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

STEINKE, T. D.
Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

STENERSEN, J.
Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

STEPHENS, J. A.
Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

STEPHENSON, D.
Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

STEPHENSON, D. E.
Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multisquifer Systems.
W91-07053 2F

STEPHENSON, G. L.
Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

STESSEL, R. I.
Efficiencies in Waste Processing.
W91-06171 5D

STEVENS, P. A.
Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

STEVENS, R. A.
Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

STEVENS, T.
Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

STEWARD, A. R.
Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

STEWART, A. J.
Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

STEWART, J. B.
Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

STICHLER, W.
Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

STIGLIANI, W. M.
Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

STODOLA, A. J. W.
Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

STONE, J. F.
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

STONEHOUSE, H. B.
Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

STORM, B.
Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

STOTT, T.
Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

STOWELL, J. P.
Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

STRADLING, D. F.
Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

STRAPP, J. W.
Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

STREET, A.
Above-Ground Landfill: The Engineered Approach.
W91-05969 5E

STREET, R. A.
Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

STREICHAN, M.
Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

STRICKLAND, T. C.
Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

STRINGER, R.
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

STROLL, J. R.
Economic Value of Wetlands-Based Recreation.
W91-06831 6B

STRUBLE, J. E.
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

STRUWE, S.
Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

STULEN, F. B.
Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

STUTSMAN, M. J.
Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

STYCZEN, M.
Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

STYPULA, J. M.
New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

SUBRAMANIAN, V.
Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

SUGAI, S. F.
Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

SUGIHARA, S.
Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

SUN, G. S.
Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

SUN, H. L.
Transformation of Alachlor by Microbial Communities.
W91-06829 7B

SUN, L.-Z.
Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

SUNDSTROM, D. W.
Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

SUPPA, P.
Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

SUSANI, L. C.
Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

SUTER, G. W.
Environmental Risk Assessment/Environmental Hazard Assessment: Similarities and Differences.
W91-06692 5C

Use of Biomarkers in Ecological Risk Assessment.
W91-06193 5A

SUTHERLAND, R. A.
Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

SUWA, H.
Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

SUZUKI, K.
Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

SUZUKI, M.
Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

SVENDSEN, H.
Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

SWAIN, W. C.
Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

SWANK, W. T.
Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

SWANSTON, D. N.
Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

SWANSTROM, C. P.
Development of a Liquid Release Tester.
W91-06140 7B

SWINDLEHURST, D. P.
Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

SYLVESTRI, P.
Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

SZARSKA, O.
Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

TABAK, H.
Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

TAI, D. Y.
Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

TAKADA, H.
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

TAKAHASHI, G.
Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

TAKAHASHI, K.
Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

TAKAHASHI, M.
Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

TAKAHASHI, T.
Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

TAKEI, A.
Erosion Research and Control in Japan.
W91-06572 4D

TAKESHIMA, Y.
Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

TAKEUCHI, T.
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

TALLAKSEN, L.
Analysis of Time Variability in Recessions.
W91-06471 2E

TAMAURA, Y.
Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

TAMURA, T.
In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

TANG, W. H.
Dam Safety Inspection Scheduling.
W91-06295 8G

TANGBORN, W.
Time-Lapse Streamflow over North America.
W91-06509 2E

TANI, M.
Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

TANNER, S. A.
Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

TARP, U.
Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

TARRER, A. R.
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

TAS, J. W.
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

TAWABINI, B. S.
Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

TAYLOR, J. S.
Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

TAYLOR, M. G.
Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

TAYLOR, P.
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

TEAL, J. M.
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

TECLE, A.
Multicriterion Forest Watershed Resources Management.
W91-06569 6A

TEDDER, D. W.
Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

TEEFY, S. M.
Performance and Analysis of Tracer Tests to Determine Compliance of a Disinfection Scheme with the SWTR.
W91-05965 5F

TEIXEIRA, E. C.
Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

TELLES, R. W.
Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

TERCIER, M.-L.
In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

TERNAN, J. L.
Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

TEWARI, H.
Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

THANGARAJAN, M.
Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

THIEBAUX, J. P.
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

THIESFELD, S. L.
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

THILENIUS, J. F.
Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

THOMAS, G. L.
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

THOMAS, G. W.
Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

THOMAS, P.
Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

THOMAS, R. B.
Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

THOMAS, R. F.
Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

THOMAS, V. K.
Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

THORNE, C. R.
Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

THUREN, A.
Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

TIAN, W.
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

TIARKS, A. E.
Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

TIDWELL, M. A.
Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

TIEDJE, J. M.
Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

TIERNAN, T. O.
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

TIETEMA, A.
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

TILLITT, D. E.
Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

TIMMERMANS, K. R.
Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

TINKER JR, J. R.
Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

TITRE, J. P.
Economic Value of Wetlands-Based Recreation.
W91-06831 6B

TITUS, J. G.
Effect of Climate Change on Sea Level Rise and the Implications for World Agriculture.
W91-06416 5C

TOMINAGA, M.
Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

TONKIN, P. J.
Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

TOPARK-NGARM, B.
Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

TORANZOS, G. A.
Tropical Source Water.
W91-06196 5F

TOSELLO, N. B.
Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

TOSUN, I.
Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

TRABALKA, J. R.
Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

TRICK, C. G.
Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

TRIDECH, S.
Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

TRLICA, M. J.
Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

TROENDLE, C. A.
Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

TROIANO, J.
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

TRUHLAR, J. F.
Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

TRUPER, H. G.
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

TSAI, K. J.
Hydromechanical Erosion Model for Surface-Mined Areas.
W91-06599 4C

TSENG, J.
Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

TSENG, J. M.
Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

TSUDA, T.
Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

TSUKAMOTO, Y.
Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

TU, P. Q.
Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

TULLIEZ, J.
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

TURCAUD, V. L.
Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

TURNER, K. S.
Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

TWISS, M. R.
Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

TYAGI, U. N.
Surface Charge on Wastewater Sludges.
W91-06439 5D

TYLER, D. D.
Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

TYUS, H. M.
Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

TYYNISMAA, M.
Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

UBELS, J. L.
Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

UDA, T.
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

UDSETH, H. R.
Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

UETA, Y.
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

UITOUDEGROENEVELD, J. P.
Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

UKITA, M.
Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

UMA, K. O.
Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

UNCLES, R. J.
Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

UNGER, P. W.
Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

UNGER, S. L.
Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

USHER, H. D.
Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

VAITHIYANATHAN, P.
Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

VALENTA, P.
Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

VALENTINO, M. A.
Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

VALIELA, I.
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

VALLETTE, J.
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

VAN DEN BERG, M.
Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

VAN DER KOLK, J.
Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

VAN DER KOOIJ, D.
Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

VAN DER MAST, C. A.
Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

VAN DER SLOOT, H. A.
Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

VAN DER WEIDEN, M. E. J.
Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

VAN DER WENDE, E.
Biofilms in Potable Water Distribution Systems.
W91-06206 5F

VAN HAVEREN, B. P.
Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

VAN LIERE, J. M.
Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

VAN MONTFRANS, J.
Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

VAN MUISWINKEL, W. B.
Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

VAN SCHILFGAARDE, J.
Management of Water Balance Components.
W91-06742 3F

VAN WINKLE, W.
Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

VANDEKOPPLE, R.
Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

VANNESS, G. F.
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

VASEL, J. L.
Oxygen Transfer in Trickling Filters.
W91-06864 5D

VASUDEVAN, T. V.
Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

VAUCLIN, M.
Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

VEIGA PIRES, L. C.
Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

VELAGALETI, R.
Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

VELDHUIZEN-TSOERKAN, M. B.
Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

VENKATESWAR, R.
Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

VENNEKER, R. G. W.
ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

VENUGOPALAN, V. K.
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

VERDEGAN, B.
Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

VERMEER, K.
High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

VERRY, E. S.
Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

VERSTRATEN, J. M.
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

VESELY, J.
Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

VESILIND, P. A.
Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

VICKERS, E. L.
Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

VIGERS, G. A.
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

VIGG, S.
Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

VIGNOLI, F. O.
Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

VIGON, B. W.
Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

VILLALOBOS, F. J.
Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

VILLELA, S. M.
Mathematical Model for Reservoir Silting.
W91-07062 2J

Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

VINUESA, J. H.
Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

VIRGINIA, R. A.
Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

VISWANADHAM, Y.
Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

VIVILLE, D.
Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

VOLK, V. V.
Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

VOLPE, R.
Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

VOOGT, P. A.
Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

VREKE, J.
Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

VUGTS, H. F.
Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

WADA, E.
Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

WADOWSKY, R. M.
Legionella in Drinking Water.
W91-06210 5A

WAGEL, D. J.
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

WALKER, C. H.
Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

WALKER, D. J.
Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

WALKER, J. D.
Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

WALKER, P. A.
Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

WALLACE, F. L.
Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

WALLACE, J. B.
Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

WALLING, D. E.
Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

WALLIS, S. G.
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

WALTER, P.
Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

WANG, C.
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

WANG, G. D.
Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

WARBURTON, J.
Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

WARD, C. J.
Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

WARD, J. B.
Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

WARD, T. J.
Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

WARINNER, J. E.
Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

WARLEN, S. M.
Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

WARREN, G. J.
Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

WARTENA, L.
Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

WATANABE, K.
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

WATSON, C. F.
Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

WATSON, J. S.
Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

WEATHERBEE, A. A.
Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

WEATHERLEY, N. S.
Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

WEAVER, W.
Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

WEAVER, W. E.
Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

WEBB, B. W.
Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

WEBER, D.
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

WEEKS, B. A.
Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

WEEKS, C. A.
Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

WEEKS, D. L.
Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

WEIGEL, J.
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

WEIGLE, D.
Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

WEIJERS, E. P.
Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

WEIL, S.
Land and Liquid Disposal Bans.
W91-06679 5E

WEINBERG, A. C.
Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

WEIR, B. A.
Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

WEIRICH, F. H.
Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

WEIS, J. S.
Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

WEIS, M.
Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

WEIS, P.
Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

WEISBERG, S. B.
Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

WEISMAN, R. N.
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

WELLER, R. R.
Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

WELLS, J. T.
Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

WELLS, W. G.
Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

WEN, C. G.
Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

WERT, M. A.
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

WEST, A. W.
Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

WESTERMAN, P. W.
Psychrophilic Anaerobic Digestion of Animal Manure: Proposed Design Methodology.
W91-06225 5D

WESTON, D. P.
Hydrocarbon Bioaccumulation from Contaminated Sediment by the Deposit-Feeding Polychaete Abarenicola pacifica.
W91-06259 5B

WETZEL, K. L.
Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

WHEATER, H. S.
Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

WHITAKER, R. P.
Network Management--the Bradford Experience.
W91-05967 5F

WHITE, S.
Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

WHITEHEAD, P. G.
Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

WHITING, P. J.
Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

WHITNEY, F. A.
Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

WHITTAKER, J. G.
Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

WIBERG, P. L.
Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

WICKRAMANAYAKE, G. B.
Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

Sewage Sludge Application to Agricultural Land.
W91-06451 5E

WICKS, J. M.
Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

WICKSTROM, C. E.
Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

WIDIARTI,
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

WIECZOREK, G. F.
Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

WIEDER, R. K.
Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

WIESNER, M. R.
Coagulation Pretreatment for Ultrafiltration of a Surface Water.
W91-05963 5F

WIJKSTRA, J.
Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

WILHELMSEN, S.
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

WILHITE, E. L.
Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

WILKE, T. S.
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

WILKINS, J. P. G.
Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

WILLEMS, A. G. M.
Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

WILLFORD, W. A.
Observations on Fish Community Health.
W91-06930 5A

WILLGOOSE, G.
Model of River Basin Evolution.
W91-07026 2J

WILLIAMS, A. G.
Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

WILLIAMS, D. C.
Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

WILLIAMS, J.
Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

WILLIAMS, J. L.
Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

WILLIAMS, T.
Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

WILLIAMSON, D. R.
Salinity--An Old Environmental Problem.
W91-07049 3C

WILLIS, M. S.
Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

WILSON, B. N.
Indoor Soil Erosion Research Facility.
W91-06232 2J

WILSON, C. J.
Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

WILSON, D. J.
Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

WILSON, R. E.
Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

WILSON, R. G.
Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

WILTSHIRE, S.
Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

WINBERG, S.
Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

WINSTON, G. W.
Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

WISSMAR, R. C.
Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

WITTENBERG, H.
Regional Analysis of Flow Duration Curves.
W91-06484 2E

WNOROWSKI, A. U.
Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

WOGAN, G. N.
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

WOHLGEMUTH, P. H.
Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

WOHLGEMUTH, P. M.
Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

WOIN, P.
Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

WOJTVLAK, M.
Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

WOLFE, M. H.
Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

WOLFE, R. A.
Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

WOLFORD, R. S.
Legionella in Drinking Water.
W91-06210 5A

WONG, C. S.
Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

WONG, K. C.
Sea Level Variability in Long Island Sound.
W91-06833 2L

WONG, R. L.
Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

WONG, S. H.
Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

WOO, B. M.
Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

WOO, M.-K.
Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

WOOD, D. D.
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

WOODIN, B.
Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

WOODIN, B. R.
Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

WOODS, B. L.
Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

WOODS, N.
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

WOOLSON, R. F.
Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

WRIGHT, V. L.
Economic Value of Wetlands-Based Recreation.
W91-06831 6B

WU, J.
Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

WU, M. W.
Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

WYER, M.
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

WYMAN, R. A.
Waste Minimization Liability Issues.
W91-06680 5G

XIANGFEI, Z.
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

XIAOHONG, L.
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

XIE, Q. C.
Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

XU, C.
Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

XU, S.
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

YACOBI, Y. Z.
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

YACOOB, M.
Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

YACYSHYN, H.
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

YAIR, A.
Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

YAMADA, H.
Determination of Soluble Selenium in Soils.
W91-06970 5A

YAMAMOTO, Y.
Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

YAMAMURO, M.
Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

YAMANOUCHI, H.
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

YAMASHITA, M.
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

YANG, J. H.
Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

YANG, J. S.
Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

YANG, Y.
Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

YANONG, R. P. E.
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

YAPA, P. D.
Spreading of Oil Spilled Under Ice.
W91-07029 5B

YAVITT, J. B.
Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

YAZAWA, A.
Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

YE, A.
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

YEAGER, T. H.
Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

YEARSLEY, E. N.
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

YEN, B. C.
Dam Safety Inspection Scheduling.
W91-06295 8G

YETIS, U.
Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

YEVICH, P.
Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

YOKOO, K.
Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

YOSHIDA, M.
Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

YOSHIOKA, R.
Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

YOUNG, C. E.
Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

YOUNG, P.
Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

YOUSIF, A. Y.
Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

YU, S.
Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

YU, Y.
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

YUDUAN, W.
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

YUNKER, M. B.
Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

YUSUF, M.
Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

ZALESKI, J.
Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

ZANCHI, C.
Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

ZANDEE, D. I.
Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

ZANDER, A. K.
Removing VOCs by Membrane Stripping.
W91-06814 5F

ZAROOGIAN, G.
Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

ZEHNDER, A. J.
Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

ZELAZNY, A.
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

ZEVENBERGEN, L. W.
Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

ZHANG, G.
Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

ZHANG, G. H.
Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

ZHANG, H.
Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

ZHANG, J.
Ecological Studies on the Hydromedusae, Siphonophores and Ctenophores in the Xiamen Harbor and Adjacent Waters.
W91-06106 2L

ZHANG, W.
Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

ZHANG, X.
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

ZHANG, X. B.
Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

ZHANG, Z.
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

ZHENXING, D.
Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

ZHIHONG, Z.
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

ZHIQING, L.
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

ZHOU, M.
Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

ZIATKIS, A.
Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

ZIEMER, R. R.
Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

ZIQUIANG, L.
Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

ZIRINO, A.
In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

ZOCH, R.
Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

ZOON, F. C.
Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

ZRNIC, D. S.
Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

ZSCHUPPE, K. H.
Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

ZUBLENA, J. P.
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

ZURCHER, C.
Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

ZWERNER, D. E.
Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

ZWICK, T. C.
Sewage Sludge Application to Agricultural Land.
W91-06451 5E

ORGANIZATIONAL INDEX

AARHUS UNIV. (DENMARK). DEPT. OF TOXICOLOGY.
Prenatal Exposure to Methyl Mercury among Greenlandic Polar Inuits.
W91-06764 5B

AARHUS UNIV. (DENMARK). ZOOPHYSIOLOGY LAB.
Histochemical Demonstration of Mercury in the Olfactory System of Salmon (Salmo salar L.) Following Treatments with Dietary Methylmercuric Chloride and Dissolved Mercuric Chloride.
W91-05999 5B

ACADEMIA SINICA, GUANGZHOU (CHINA). SOUTH CHINA SEA INST. OF OCEANOLOGY.
Study of Mixing Rates and Sedimentation Rates in Meizhou Bay Sediments.
W91-06101 2L

Interfacial Geochemistry of Barium in Suspension and Sediment from Zhujiang Estuary.
W91-06220 5B

ACADEMIA SINICA, QINGDAO (CHINA). INST. OF OCEANOLOGY.
Neutron Activation Analysis (NAA) and Geochemical Studies of 38 Elements in Surface Sediments from Lower Reach and Estuary of Huanghe (Yellow) River.
W91-06219 2J

ACER ENVIRONMENTAL, STEVENAGE (ENGLAND).
Disinfection of Sewage, Stormwater and Final Effluent.
W91-05968 5D

AFRC INST. OF GRASSLAND AND ANIMAL PRODUCTION, HURLEY (ENGLAND).
Odour and Ammonia Emissions Following the Spreading of Aerobically-Treated Pig Slurry on Grassland.
W91-06226 5E

AGRICULTURAL DEVELOPMENT AND ADVISORY SERVICE, HARPENDEN (ENGLAND). CENTRAL SCIENCE LAB.
Rationalisation of the Mass Spectrometric and Gas Chromatographic Behaviour of Organophosphorus Pesticides Part 1: Substituted Phenyl Phosphorothioates.
W91-06793 5A

AGRICULTURAL RESEARCH AND EDUCATION CENTER, MONTICELLO, FL.
Water Use and Average Growth Index of Five Species of Container Grown Woody Landscape Plants.
W91-06420 3F

AGRICULTURAL RESEARCH ORGANIZATION, BET-DAGAN (ISRAEL). VOLCANI CENTER.
Involvement of Soil Microorganisms in the Accelerated Degradation of Diphenamid.
W91-06985 5B

AGRICULTURAL RESEARCH SERVICE, BUSHLAND, TX. CONSERVATION AND PRODUCTION RESEARCH LAB.
Land-Leveling Effects on Soil Texture, Organic Matter Content, and Aggregate Stability.
W91-06276 3F

AGRICULTURAL RESEARCH SERVICE, FORT COLLINS, CO. HYDRO-ECOSYSTEM RESEARCH UNIT.
Sediment Losses from Cropland Furrows.
W91-07058 2J

AGRICULTURAL RESEARCH SERVICE, FORT COLLINS, CO. NORTHERN PLAINS AREA.
Management of Water Balance Components.
W91-06742 3F

AGRICULTURAL RESEARCH SERVICE, FORT COLLINS, CO. SOIL-PLANT-NUTRIENT RESEARCH UNIT.
Ground Water Quality Concerns about Nitrogen.
W91-06732 5B

AGRICULTURAL RESEARCH SERVICE, FRESNO, CA. WATER MANAGEMENT RESEARCH LAB.
Influence of Selenium, Salinity, and Boron on Selenium Uptake in Wild Mustard.
W91-07007 5B

AGRICULTURAL RESEARCH SERVICE, LINCOLN, NE.
Proper Accounting for N in Cropping Systems.
W91-06737 3F

Estimation of N Budgets for Crops.
W91-06739 3F

AGRICULTURAL RESEARCH SERVICE, OXFORD, MS.
Effects of Past Erosion on the Interrill Erodibility of a Fragipan Soil.
W91-06234 2J

AGRICULTURAL RESEARCH SERVICE, PHOENIX, AZ. WATER CONSERVATION LAB.
Linkages with Ground Water.
W91-06743 2F

AGRICULTURAL RESEARCH SERVICE, PROSSER, WA.
Preplant Tillage Effects on Irrigated Corn Grown on a Sandy Soil.
W91-06303 3F

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CA. SALINITY LAB.
Soil Electrical Conductivity: Effects of Soil Properties and Application to Soil Salinity Appraisal.
W91-06789 2G

AGRICULTURAL RESEARCH SERVICE, ST. PAUL, MN.
Characterization of Alachlor and Atrazine Desorption from Soils.
W91-06982 5B

AGRICULTURAL RESEARCH SERVICE, TIFTON, GA. SOUTHEAST WATERSHED RESEARCH LAB.
Transformations and Movement of Nitrate in Aquifer Systems.
W91-06744 5B

AGRICULTURAL RESEARCH SERVICE, TUCSON, AZ.
US National Project to Develop Improved Erosion Prediction Technology to Replace the USLE.
W91-07107 2J

AGRICULTURAL RESEARCH SERVICE, TUCSON, AZ. ARIDLAND WATERSHED MANAGEMENT RESEARCH UNIT.
Modelling Sedimentation Processes in Small Watersheds.
W91-07109 2J

AGRICULTURAL RESEARCH SERVICE, UNIVERSITY PARK, PA. NORTHEAST WATERSHED RESEARCH CENTER.
Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia.
W91-07055 5G

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF HYDRAULICS AND CATCHMENT HYDROLOGY.
Study on the Effect of Changes of Groundwater Levels on Soil Moisture Condition and Evapotranspiration.
W91-06488 2F

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF METEOROLOGY.
Moisture Distribution Within a Maize Crop Due to Dew.
W91-06933 2I

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF MICROBIOLOGY.
Nitrate Accumulation in Leaves of Vegetation of a Forested Ecosystem Receiving High Amounts of Atmospheric Ammonium Sulfate.
W91-06309 5C

Role of Substrate Concentration in Particle Size Distribution of Methanogenic Sludge in UASB Reactors.
W91-06860 5D

AGRICULTURE CANADA, LETHBRIDGE (ALBERTA). RESEARCH STATION.
Rates of Soil Chemical Changes with Eleven Annual Applications of Cattle Feedlot Manure.
W91-06408 5B

AIR FORCE ACADEMY, CO. DEPT. OF CIVIL ENGINEERING.
Effect of Surfactants on the Sorption Partition Coefficients of Naphthalene on Aquifer Soils.
W91-06089 5G

AIR FORCE ENGINEERING AND SERVICES CENTER, TYNDALL AFB, FL.
Methods for Monitoring Solvent Condition and Maximizing Its Utilization.
W91-06166 5E

AKADEMIA ROLNICZA, WROCLAW (POLAND). INST. OF HYDRO- AND GEOTECHNICS.
Use of the Flow Recession Curve for the Estimation of Conditions of River Supply by Underground Water.
W91-06469 2E

AKRON UNIV., OH. DEPT. OF CHEMICAL ENGINEERING.
Sludge and Wastewater Filtration: A Continuum Analysis.
W91-06423 5D

ALABAMA UNIV. IN HUNTSVILLE.
Error Structure of Multiparameter Radar and Surface Measurements of Rainfall. Part III: Specific Differential Phase.
W91-06110 2B

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Transport and Sediment Accumulation of Pb-210 and Cs-137 in Two Southeast Alaskan Fjords.
W91-06835 2J

ALBERTA AGRICULTURE, LETHBRIDGE. LAND EVALUATION AND RECLAMATION BRANCH.
Irrigation Suitability of Solonetzic Soils in the County of Newell, Alberta.
W91-06409 3F

ALBERTA ENVIRONMENTAL CENTRE, VEGREVILLE.
Comparative Studies of Metal Containment in Solidified Matrices by Scanning and Transmission Electron Microscopy.
W91-06141 5E

ALBERTA UNIV., EDMONTON. DEPT. OF SOIL SCIENCE.
Grazing Impacts on Infiltration in Mixed Prairie and Fescue Grassland Ecosystems of Alberta.
W91-06406 4C

ALBERTA UNIV., EDMONTON. ENVIRONMENTAL AND OCCUPATIONAL HEALTH PROGRAM.
Drinking Water Flouridation and Osteosarcoma.
W91-05993 5F

ALLIANCE TECHNOLOGIES CORP., BEDFORD, MA.
Results of Field Sampling Programs Conducted at Waste Solvent Treatment and Recycling Facilities.
W91-06165 5E

AMERICAN WATER WORKS SERVICE CO., INC., BELLEVILLE, IL.
Microbiology of Activated Carbon.
W91-06199 5F

AMSTERDAM UNIV. (NETHERLANDS). DEPT. OF FUNDAMENTAL AND APPLIED ECOLOGY.
Fate of Trace Metals During the Metamorphosis of Chironomids (Diptera, Chironomidae).
W91-06807 5B

AMSTERDAM UNIV. (NETHERLANDS). LAB. FOR PHYSICAL GEOGRAPHY AND SOIL SCIENCE.
Proton Cycle of a Deciduous Forest Ecosystem in the Netherlands and Its Implications for Soil Acidification.
W91-06317 5B

ANDHRA UNIV., WALTAIR (INDIA). DEPT. OF ZOOLOGY.
Haematological Effects in Fishes from Complex Polluted Waters of Visakhapatnam Harbour.
W91-06264 5C

AQUILA UNIV. (ITALY). DEPT. OF CHEMISTRY.
Experimental Evaluation of Limiting Factors for Leaching Mechanism in Solidified Hazardous Wastes.
W91-06143 5E

ARGONNE NATIONAL LAB., IL. ENERGY SYSTEMS DIV.
Dissolved Air, Induced Air, and Nozzle Air Flotation System Performance Comparison for Precipitation Flotation of Metal-Laden Wastewaters.
W91-06433 5D

ARGONNE NATIONAL LAB., IL. ENVIRONMENTAL RESEARCH DIV.
Biodegradable Plastics from Potato Waste Double Savings to Environment.
W91-06872 5D

ARIZONA UNIV., TUCSON. DEPT. OF NUTRITION AND FOOD SCIENCE.
Viruses in Source and Drinking Water.
W91-06212 5F

ARIZONA UNIV., TUCSON. SCHOOL OF RENEWABLE NATURAL RESOURCES.
Multicriterion Forest Watershed Resources Management.
W91-06569 6A

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF AGRONOMY.
Degradation and Field Persistence of Imazethapyr.
W91-06830 5B

Dissipation of Norflurazon and Other Persistent Herbicides in Soil.
W91-06983 5B

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF ENTOMOLOGY.
Evaluation of Bacillus Sphaericus 2362 Against Culex Quinquefasciatus in Septic Ditches.
W91-06825 5D

ARKANSAS UNIV., HOPE. SOUTHWEST RESEARCH AND EXTENSION CENTER.
Drought-Induced Accumulation of Nitrate in Grain Sorghum.
W91-06300 2G

ARMY BIOMEDICAL RESEARCH AND DEVELOPMENT LAB., FORT DETRICK, MD.
Octanol/Water Partition Coefficient of Methylmercuric Chloride and Methylmercuric Hydroxide in Pure Water and Salt Solutions.
W91-06991 5B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.
Metal Immobilization by Solidification of Hydroxide and Xanthate Sludges.
W91-06146 5E

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. ENVIRONMENTAL LAB.
Use of Hazard Models in Evaluating the Effect of Exposure Duration on the Acute Toxicity of Three Pesticides.
W91-06708 5C

Macrophyte Influences on the Zonation of Sediment Accretion and Composition in a North-Temperate Reservoir.
W91-06759 2J

Acute Toxicity of PCB Congeners to Daphnia magna and Pimephales promelas.
W91-06888 5C

ASSOCIATED TECHNOLOGIES, INC., CHARLOTTE, NC.
Use of Bitumen in the Stabilization of Mixed Wastes.
W91-06127 5E

ATMOSPHERIC ENVIRONMENT SERVICE, TORONTO (ONTARIO).
Vertical Distribution of Aerosols and Acid Related Compounds in Air and Cloudwater.
W91-06878 5B

ATOMIC ENERGY OF CANADA LTD., CHALK RIVER (ONTARIO). CHALK RIVER NUCLEAR LABS.
Leaching Low-Level Radioactive Waste in Simulated Disposal Conditions.
W91-06151 5B

ATOMIC ENERGY OF CANADA LTD., PINAWA (MANITOBA). WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT.
Solubility and Stability of Inorganic Iodides: Candidate Waste Forms for Iodine-129.
W91-06148 5E

AUBURN UNIV., AL. DEPT. OF CHEMICAL ENGINEERING.
Demetallation of Used Oil to Facilitate Its Utilization as a Fuel.
W91-06169 5D

AUSTRALIAN NUCLEAR SCIENCE AND TECHNOLOGY ORGANISATION, SUTHERLAND.
Method for Determining Sediment Budgets Using Caesium-137.
W91-07076 2J

BAGHDAD UNIV. (IRAQ). DEPT. OF GEOLOGY.
Periodicity of Suspended Sediment Concentrations in the River Tigris at Baghdad Identified Using Short Interval Sampling.
W91-07095 2J

BALATONI LIMNOLOGIAI KUTATO INTEZETE, TIHANY (HUNGARY).
Impact of Cd and Different pH on the Amphipod Gammarus Fossarum Koch (Crustacea: Amphipoda).
W91-07018 5C

BANARAS HINDU UNIV., VARANASI (INDIA). CENTRE FOR ADVANCED STUDY IN BOTANY.
Cadmium Toxicity to Photosynthesis and Associated Electron Transport System of Nostoc linckia.
W91-05988 5C

BAR-ILAN UNIV., RAMAT GAN (ISRAEL). DEPT. OF GEOGRAPHY.
Spatial Variability of Overland Flow in a Small Arid Basin.
W91-06724 2E

BARCELONA UNIV. (SPAIN). DEPT. DE ECOLOGIA.
Some Factors Affecting Distribution of Diatom Assemblages in Pyrenean Springs.
W91-06270 2H

BASF AKTIENGESELLSCHAFT, LIMBURGERHOF (GERMANY, F.R.). AGRICULTURAL RESEARCH STATION.
Ground Water Nitrates in Other Developed Countries (Europe)--Relationships to Land Use Patterns.
W91-06735 5B

BASRAH UNIV. (IRAQ). DEPT. OF FISHERIES AND MARINE RESOURCES.
Composition, Seasonality and Abundance of Fishes in the Shatt Al-Basrah Canal, an Estuary in Southern Iraq.
W91-06768 2L

BATTELLE COLUMBUS DIV., OH.
Adequacy of Analytical Techniques to Determine the Fate of Polyelectrolytes in Waste Treatment.
W91-06442 5D

Electroacoustic Soil Decontamination Process for In-Situ Treatment of Contaminated Soils.
W91-06446 5G

Using Waste Management Products as an Alternative to Depleting Nonrenewable Fertilizer Sources.
W91-06450 5E

Recent Developments in Solid/Liquid Separation Including Electrotechnologies.
W91-06453 5D

Ultrasonic Interactions During Sludge Dewatering.
W91-06456 5D

Scale-up of Electroacoustic Dewatering of Sewage Sludges.
W91-06457 5D

Electromembrane Technology: A Novel Approach for Antifouling.
W91-06458 5D

BATTELLE, COLUMBUS, OH. ENVIRONMENTAL BIOLOGY AND ASSESSMENT.
Chronic and Sublethal Toxicities of Surfactants to Aquatic Animals: a Review and Risk Assessment.
W91-06871 5C

BATTELLE-INST. E.V., FRANKFURT AM MAIN (GERMANY, F.R.).
Mechanical and Thermal Treatment of Dredged Material to Produce Ceramic Pellets.
W91-06435 5E

BATTELLE/MARINE SCIENCES LAB., SEQUIM, WA.
Sedimentary Geology of the Columbia River Estuary.
W91-06280 2L

BATTELLE MEMORIAL INST., COLUMBUS, OH.
Sewage Sludge Application to Agricultural Land.
W91-06451 5E

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA.
Influence of Hydrologic Factors on Leaching of Solidified Low-Level Waste Forms at an Arid-Site Field-Scale Lysimeter Facility.
W91-06153 5E

Confirmation and Quantitation of Hydroxymethanesulfonate in Precipitation by Electrospray Ionization-Tandem Mass Spectrometry.
W91-06874 5C

BAYERO UNIV., KANO (NIGERIA). DEPT. OF GEOGRAPHY.
Dynamics of Gully Head Recession in a Savanna Environment.
W91-06726 2J

BERGEN UNIV. (NORWAY). DEPT. OF BIOCHEMISTRY.
Evaluation of Biochemical Responses to Environmental Contaminants in Flatfish from the Hvaler Archipelago in Norway.
W91-06331 5C

BERGEN UNIV. (NORWAY). DEPT. OF MARINE BIOLOGY.
Impact of Freshwater Runoff on Physical Oceanography and Plankton Distribution in a Western Norwegian Fjord: An Experiment with a Controlled Discharge from a Hydroelectric Power Plant.
W91-06766 2L

Coupled Physical-Biological Pelagic Model of a Shallow Sill Fjord.
W91-06771 2L

BIDHAN CHANDRA KRISHI VISWA VIDYALAYA, MOHANPUR (INDIA). DEPT. OF AGRICULTURAL CHEMISTRY AND SOIL SCIENCE.
Degradation of Pendimethalin by Soil Fungi.
W91-06795 5B

BIOLOGICAL STATION, LUNZ AM SEE (AUSTRIA).
Effect of Escape Reactions on the Quantitative Sampling of Gravel Stream Fauna.
W91-06753 7B

BIOLOGISCHE ANSTALT HELGOLAND (GERMANY, F.R.)
Cellular Effects of Environmental Contamination in Fish from the River Elbe and the North Sea.
W91-06379 5C

New Toxicity Testing Method Using Marine Bacterivorous Nanoflagellates.
W91-06885 5C

BOSTON UNIV., MA. MARINE BIOLOGICAL LAB.
Transport of Groundwater-Borne Nutrients from Watersheds and Their Effects on Coastal Waters.
W91-06950 5B

BRIGHAM YOUNG UNIV., PROVO, UT. DEPT. OF CHEMISTRY.
Heavy Metal Removal Using Bound Macrocycles.
W91-06072 5F

BRISTOL UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Towards a Dynamic Model of Gully Growth.
W91-06725 2J

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT, VICTORIA.
Method for Predicting Terrain Susceptible to Landslides Following Forest Harvesting: A Case Study from the Southern Coast Mountains of British Columbia.
W91-06523 2J

BRITISH COLUMBIA MINISTRY OF FORESTS, KAMLOOPS. HYDROLOGY RESEARCH SECTION.
Root Zone Drainage from a Humid Forest Soil in the West Coast of Canada.
W91-06546 2G

Streamflow Characteristics of Two Small, Steep and Forested Watersheds in High Elevation Areas of Central Taiwan.
W91-06557 4C

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF GEOGRAPHY.
Mechanisms of Debris Supply to Steep Channels Along Howe Sound, Southwest British Columbia.
W91-06592 2J

BRITISH COLUMBIA UNIV., VANCOUVER. FACULTY OF FORESTRY.
Influence of Acid Precipitation on Stream Chemistry in a Small Forested Basin in Southwestern British Columbia.
W91-06514 5B

Changes in Streamflow Peaks following Timber Harvest of a Coastal British Columbia Watershed.
W91-06558 4C

BRITISH MUSEUM OF NATURAL HISTORY, LONDON (ENGLAND). DEPT. OF BOTANY.
Observations on the Phytobenthos of the Freshwater Thames: III. The Floristic Composition and Seasonality of Algae in the Tidal and Non-Tidal River.
W91-06760 2H

BROOKHAVEN NATIONAL LAB., UPTON, NY. NUCLEAR WASTE RESEARCH GROUP.
Leaching-Induced Concentration Profiles in the Solid Phase of Cement.
W91-06149 5E

BUCKNELL UNIV., LEWISBURG, PA. DEPT. OF BIOLOGY.
Dissolved Organic Carbon Dynamics in a Small Stream.
W91-06009 2H

BUENOS AIRES UNIV. (ARGENTINA). DEPT. CIENCIAS BIOLOGICAS.
Effects of Lindane and Acetone on the Development of Larvae of the Southern King Crab (Lithodes antarcticus Jaquinot).
W91-06884 5C

BUENOS AIRES UNIV. (ARGENTINA). DEPT. OF TOXICOLOGY.
Polluted Water Concentrates: Induction of Genetic Alterations in Saccharomyces cerevisiae D7 Strain.
W91-06887 5C

BUREAU OF LAND MANAGEMENT, LAKEWOOD, CO. DENVER SERVICE CENTER.
Predicting Channel Responses to Changing Flow Regimes: Beaver Creek, Alaska.
W91-06629 2J

CALCUTTA MUNICIPAL CORP. (INDIA).
Chlorination of Drinking Water and Cancer.
W91-06898 5F

CALIFORNIA DEPT. OF FOOD AND AGRICULTURE, SACRAMENTO. ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM.
Enzyme Immunoassay for the Determination of Atrazine Residue in Soil.
W91-05986 5A

CALIFORNIA INST. OF TECH., PASADENA. DIV. OF BIOLOGY.
Metallothionein: A Potential Biomonitor of Exposure to Environmental Toxins.
W91-06188 5A

CALIFORNIA UNIV., BERKELEY. DEPT. OF GEOLOGY AND GEOPHYSICS.
Overview: 'Zero-Order Basins' and Problems of Drainage Density, Sediment Transport and Hillslope Morphology.
W91-06573 2J

Size and Location of Colluvial Landslides in a Steep Forested Landscape.
W91-06574 2J

Contribution of Bedrock Groundwater Flow to Storm Runoff and High Pore Pressure Development in Hollows.
W91-06575 2J

CALIFORNIA UNIV., BERKELEY. DEPT. OF PLANT AND SOIL BIOLOGY.
Acidity and Alkalinity of Reservoir Water in the Sierra Nevada, California.
W91-06512 5B

CALIFORNIA UNIV., BERKELEY. KEARNEY FOUNDATION OF SOIL SCIENCE.
El Nino Effects on Hydrogen Ion Concentration of a California Reservoir.
W91-06943 5B

CALIFORNIA UNIV., DAVIS. DEPT. OF GEOLOGY.
Role of Magnetic Measurements in the Development of a River Basin Erosional History.
W91-06653 7B

CALIFORNIA UNIV., DAVIS. SCHOOL OF VETERINARY MEDICINE.
Liver Structural Alterations Accompanying Chronic Toxicity in Fishes: Potential Biomarkers of Exposure.
W91-06177 5A

In vivo Microscopy of Liver Microvasculature in Rainbow Trout (Oncorhynchus mykiss).
W91-06377 5A

Environmental Contamination and Cancer in Fish.
W91-06378 5C

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY.
Initiation and Mechanics of Debris Avalanches on Steep Forest Slopes.
W91-06586 2J

Sediment Transport and Deposition by Fire-Related Debris Flows in Southern California.
W91-06615 2J

CALIFORNIA UNIV., PARLIER. MOSQUITO CONTROL RESEARCH LAB.
Efficacy of a Juvenile Hormone Mimic, Pyriproxyfen (S-31183), for Mosquito Control in Dairy Wastewater Lagoons.
W91-06123 5D

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF ENTOMOLOGY.
Fate and Persistence of Bacillus Sphaericus Used as a Mosquito Larvicide in Dairy Wastewater Lagoons.
W91-06823 5D

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
Long-Term Environmental Effects Associated with Land Application of Municipal Sludges: A Review.
W91-06452 5E

Nitrate Transport and Leaching Mechanisms.
W91-06736 5B

CALIFORNIA UNIV., SANTA BARBARA. DEPT. OF GEOLOGICAL SCIENCES.
Relationships Between Channel Morphology, Unit Stream Power, and Sediment Routing and Storage in a Steep, Bedrock Controlled Channel.
W91-06613 2E

Stream Channel Response to the Removal of Large Woody Debris, Larry Damm Creek, Northwestern California.
W91-06635 2J

CAMP, DRESSER AND MCKEE, INC., CAMBRIDGE, MA.
Diatomaceous Earth Filtration of Cysts and Other Particulates Using Chemical Additives.
W91-05962 5F

CANTABRIA UNIV., SANTANDER (SPAIN). LAB. DE ECOLOGIA.
Influence of Tidal Conditions and River Volume on Phytoplankton Distribution and Composition in the Pas Estuary (Northern Spain).
W91-06939 2L

CANTERBURY AGRICULTURE AND SCIENCE CENTRE, LINCOLN (NEW ZEALAND).
Measurement of Water Use and Pasture Growth on Templeton Silt Loam.
W91-06307 2G

CARNEGIE-MELLON UNIV., PITTSBURGH, PA. DEPT. OF CIVIL ENGINEERING.
Surfactant Solubilization of Polycyclic Aromatic Hydrocarbon Compounds in Soil-Water Suspension.
W91-06091 5G

CARTWRIGHT CONSULTING CO., ST. PAUL, MN.
Membrane Separation Technologies in Pollution Control: Case Histories.
W91-06460 5D

CASE WESTERN RESERVE UNIV., CLEVELAND, OH. DEPT. OF BIOLOGY.
Commentary on Fish Community Health: Monitoring and Assessment in Large Lakes.
W91-06928 5A

CEA CENTRE D'ETUDES NUCLEAIRES DE SACLAY, GIF-SUR-YVETTE (FRANCE).
Experience Acquired in the Field of Long-Term Leaching Tests on Blocks of Radioactive Waste.
W91-06154 5E

CENTRAL ELECTRICITY GENERATING BOARD, LONDON (ENGLAND). ENVIRONMENTAL POLICY DEPT.
Acid Rain.
W91-06236 5B

CENTRE D'ETUDES D'OCEANOGRAPHIE ET DE BIOLOGIE MARINE, ROSCOFF (FRANCE).
Population Dynamics and Secondary Production of Owenia fusiformis Delle Chiaje (Polychaeta) from the Bay of Seine (Eastern English Channel).
W91-06246 2H

CENTRE D'OCEANOLOGIE DE MARSEILLE (FRANCE).
Effect of Crude Oil on Denitrification and Sulfate Reduction in Marine Sediments.
W91-06949 5C

CENTRE DE PEDOLOGIE BIOLOGIQUE, VANDOEUVRE-LES-NANCY (FRANCE).
Nitrification and Nitrate Uptake: Leaching Balance in a Declined Forest Ecosystem in Eastern France.
W91-06308 5B

Biodegradation of Synthetic Organo-Metallic Complexes of Iron and Aluminum with Selected Metal to Carbon Ratios.
W91-06965 2K

CENTRE DE RECHERCHES DE RENNES (FRANCE). LAB. DE SCIENCE DU SOL.
Morphological Assessment of Soil Microtopography Using a Digital Elevation Model on One Square Metre Plots.
W91-06904 2E

CENTRE DE RECHERCHES OCEANOGRAPHIQUES DE DAKAR-THIAROYE (SENEGAL).
Dissolved Organic Matter and UV Absorption in a Tropical Hyperhaline Estuary.
W91-06821 2L

CENTRE DES SCIENCES DE L'ENVIRONMENT, METZ (FRANCE).
Bacterial Distribution and Sampling Strategies for Drinking Water Networks.
W91-06204 5F

CENTRE FOR AGROBIOLOGICAL RESEARCH, WAGENINGEN (NETHERLANDS).
Effect of Pattern of Water Supply on Vicia faba L.: 1. Dry Matter Partitioning and Yield Variability.
W91-06932 3F

Effect of Pattern of Water Supply on Vicia Faba L.: 2. Pod Retention and Filling, and Dry Matter Partitioning, Production and Water Use.
W91-06934 3F

CENTRE FOR WATER RESOURCES DEVELOPMENT AND MANAGEMENT, CALICUT (INDIA).
Studies on the Hydrological Processes in the Forest Drainage Basins of the Western Ghats of India.
W91-06531 4A

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, GRENOBLE (FRANCE). INST. DE MECANIQUE DE GRENOBLE.
Spatial Variability of an Agricultural Field: Geostatistical Analysis of Soil Texture, Soil Moisture and Yield Components of Two Rainfed Crops.
W91-06906 2G

CENTRE NATIONAL DU MACHINISME AGRICOLE, DU GENIE RURAL, DES EAUX ET DES FORETS, AIX-EN-PROVENCE (FRANCE). AIX-EN PROVENCE GROUP.
Research Drainage Basin of the Real Collobrier (Mediterranean France): Flow Modelization and Regional Analysis.
W91-06503 2E

CENTRE NATIONAL DU MACHINISME AGRICOLE, DU GENIE RURAL, DES EAUX ET DES FORETS, SAINT-MARTIN D'HERES (FRANCE). GRENOBLE GROUP.
Management of Sediment Monitoring at the Draix Experimental Basins (La Gestation du Bassin Versant Experimental de Draix pour la Mesure de l'Erosion).
W91-07085 2J

CENTRE SCIENTIFIQUE DE MONACO, MONTE CARLO.
Alteration of Calcium Transport as a Mechanism of Cell Injury Induced by HgCl2 in Sea Urchin Eggs.
W91-06355 5C

CENTRO DE EDAFOLOGIA Y BIOLOGIA APLICADA DEL SEGURA, MURCIA (SPAIN).
Color Changes of Organic Wastes during Composting and Maturation Processes.
W91-06971 5E

CH DIAGNOSTIC & CONSULTING SERVICE, FORT COLLINS, CO.
Waterborne Giardiasis.
W91-06207 5F

CH2M HILL, BOSTON, MA.
Extraction Procedure Toxicity and Toxicity Characteristic Leaching Procedure Extractions of Industrial and Solidified Hazardous Waste.
W91-06137 5E

CH2M HILL, INC., GAINESVILLE, FL.
Desalting Practices in the United States.
W91-06808 3A

CHADWICK AND ASSOCIATES, LITTLETON, CO.
Effects of Varying Current on Weight Loss from Willow Leaf Packs.
W91-06011 2H

CHEMICAL RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, ABERDEEN PROVING GROUND, MD. ENVIRONMENTAL TOXICOLOGY BRANCH.
Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine.
W91-06696 5B

Aquatic Toxicity of the Sensory Irritant and Riot Control Agent Dibenz-(b,f)-1,4-Oxazepine (CR).
W91-06703 5C

CHEMICAL WASTE MANAGEMENT, INC., GENEVA, IL.
Development of a Liquid Release Tester.
W91-06140 7B

CHENGDU INST. OF GEOGRAPHY (CHINA).
Erosion Processes and Effects of Debris Flow.
W91-06596 2J

Erosion Process in the Middle and Upper Reaches of the Yangzi River.
W91-06647 2J

CHENGDU UNIV. OF SCIENCE AND TECHNOLOGY (CHINA). DEPT. OF HYDRAULIC ENGINEERING.
Model Experiments on Bed Load Transport in the Variable Backwater Zone of a Reservoir.
W91-07063 2J

Development and Flume Calibration of a New Type of Near-Streambed Suspended Load Sampler.
W91-07081 2J

CHICAGO UNIV., IL. LAB. FOR ATMOSPHERIC PROBING.
Method for Improving Rain Estimates from Vertical-Incidence Doppler Radar Observations.
W91-06112 7B

CHUO UNIV., TOKYO (JAPAN). INST. OF GEOSCIENCES.
Tombi Landslide and Its Impact on the Joganji River, Japan.
W91-06584 2J

CINCINNATI UNIV., OH. DEPT. OF CHEMICAL ENGINEERING.
Determination of Monod Kinetics of Toxic Compounds by Respirometry for Structure--Biodegradability Relationships.
W91-06664 5D

CINCINNATI UNIV., OH. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Application of a Mobile Solvent Recovery Process to Minimize Hazardous Waste.
W91-06167 5D

CINCINNATI UNIV., OH. DEPT. OF GEOLOGY.
Late Wisconsin Iceberg-Calving Rates and Ice-Sheet Mass Balance Reconstructed from Paleo-Sea Levels, Mount Desert Island, Maine.
W91-06412 2C

CITADEL, CHARLESTON, SC.
Effects of Controlled Burning on Aedes Taeniorhynchus Eggs in an Abandoned Rice Impoundment in South Carolina.
W91-06826 4A

CLARKSON UNIV., POTSDAM, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Spreading of Oil Spilled Under Ice.
W91-07029 5B

CLEMSON UNIV., SC. DEPT. OF AGRICULTURAL ENGINEERING.
Locating Lagoon Seepage with Radar and Electromagnetic Survey.
W91-06801 5B

CLEMSON UNIV., SC. DEPT. OF AGRONOMY AND SOILS.
Persistence of Carbamothioate Herbicides in Soils Pretreated with Butylate.
W91-06986 5B

CLEMSON UNIV., SC. DEPT. OF MICROBIOLOGY.
Effect of Herbicide Residues on Microbial Processes in Pond Sediment.
W91-06777 5C

CLYDE RIVER PURIFICATION BOARD, EAST KILBRIDE (SCOTLAND).
Self-Protection of Escherichia Coli in Seawater.
W91-05972 5A

COAL TECHNOLOGY CORP., BRISTOL, VA.
Decanting and Filtration in a High-Gravity Centrifugal Dryer.
W91-06432 5D

COIMBRA UNIV. (PORTUGAL). DEPT. DE ZOOLOGIA.
Heterotrophic Plate Counts and the Isolation of Bacteria from Mineral Waters on Selective and Enrichment Media.
W91-06005 5A

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.
Sludge Dewatering by Natural Freeze-Thaw.
W91-06430 5D

COLOG, INC., GOLDEN, CO. BOREHOLE GEOPHYSICAL SERVICES.
Monitoring Well Completion Evaluation with Borehole Geophysical Density Logging.
W91-06850 8G

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRONOMY.
Fertilizer Nitrogen Management.
W91-06738 3F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Hydraulics and Transport at High Fine Sediment Loads.
W91-06625 2J

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF EARTH RESOURCES.
Effects of Hydrochemistry Variability on Water Quality Sampling Frequencies in an Alpine-Subalpine Forest Basin.
W91-06548 2K

Temporal and Spatial Variability of Sediment Storage and Erosion in Ash Creek, Arizona.
W91-06614 2J

Response of Bed Topography to Increased Bed Load, Fall River, Colorado.
W91-06626 2J

Tributary Entrenchment in Response to Lowered Base Level Below a Dam.
W91-06628 4C

Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure.
W91-06644 4C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF RANGE SCIENCE.
Soil Water Dynamics, Transpiration, and Water Losses in a Crested Wheatgrass and Native Shortgrass Ecosystem.
W91-06314 2I

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF WATER AND LAND RESOURCES.
Prediction of Hydrological Similarity in the Hunter Valley, Australia.
W91-06475 2E

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, ST. LUCIA (AUSTRALIA). DIV. OF TROPICAL CROPS AND PASTURES.
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water Limited Conditions: II. Water Stress after Anthesis.
W91-06942 2I

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, WEMBLEY (AUSTRALIA). DIV. OF WATER RESOURCES.
Salinity--An Old Environmental Problem.
W91-07049 3C

CONNECTICUT DEPT. OF ENVIRONMENTAL PROTECTION, HARWINTON. INLAND FISHERIES DIV.
Catch-and-Release Management of a Trout Stream Contaminated with PCBs.
W91-06030 8I

CONNECTICUT UNIV., STORRS. DEPT. OF AGRICULTURAL AND RESOURCE ECONOMICS.
Dynamics of Declining Soil Erosion Rates.
W91-06231 2J

CONNECTICUT UNIV., STORRS. DEPT. OF CHEMICAL ENGINEERING.
Destruction of Mixtures of Pollutants by UV-Catalyzed Oxidation with Hydrogen Peroxide.
W91-06660 5D

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS, MADRID (SPAIN). INST. DE QUIMICA ORGANICA GENERAL.
Lindane Pollution Near an Industrial Source in Northeast Spain.
W91-05983 5B

CONTRA COSTA MOSQUITO ABATEMENT DISTRICT, CONCORD, CA.
Laboratory Evaluation of Lagenidium giganteum (Oomycetes: Lagenidiales) in Water from Contra Costa County, California, Mosquito Sources.
W91-06122 5G

COPENHAGEN UNIV. (DENMARK). DEPT. OF GENERAL MICROBIOLOGY.
Seasonality of Denitrification in Water-logged Alder Stands.
W91-06322 2H

COPENHAGEN UNIV. (DENMARK). INST. OF GEOGRAPHY.
Identification of Sources of Sediment Transport in Small Basins with Special Reference to Particulate Phosphorus.
W91-07084 2J

CORNELL UNIV., ITHACA, NY. ECOSYSTEMS RESEARCH CENTER.
Pollutant Dynamics as Influenced by Seagrass Beds: Experiments with Tributyltin in Thalassia Microcosms.
W91-06242 5B

CORNELL UNIV., ITHACA, NY. LAB. OF SOIL MICROBIOLOGY.
Explanation for the Decline of Bacteria Introduced into Lake Water.
W91-06023 5B

CORNELL UNIV., ITHACA, NY. SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Effects of Soil Properties and Moisture on Sorption of Trichloroethylene Vapor.
W91-06861 5B

Computation (Investigation, Education, and Application).
W91-07027 8B

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA). DIV. OF WATER TECHNOLOGY.
Occurrence and Significance of Toxic Cyanobacteria in Southern Africa.
W91-06057 5B

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA).

Selection of Bacterial and Fungal Strains for Bioaccumulation of Heavy Metals from Aqueous Solutions.
W91-06073 5D

COVENTRY (LANCHESTER) POLYTECHNIC (ENGLAND). DEPT. OF GEOGRAPHY.
Acid Buffering in Lowland Forested Ecosystems: A Case Study in the Trent Basin, UK.
W91-06515 5B

Sedimentary Data Base: An Appraisal of Lake and Reservoir Sediment Based Studies of Sediment Yield.
W91-06719 2J

Lake-Catchments: An Evaluation of Their Contribution to Studies of Sediment Yield and Delivery Process.
W91-07101 2J

DAMES AND MOORE, SAN FRANCISCO, CA.
Making the Most of Bottoms and Residuals.
W91-06688 5D

DANISH INST. OF APPLIED HYDRAULICS, HOERSHOLM.
Simulation of Water Flow and Soil Erosion Processes with a Distributed Physically-based Modelling System.
W91-06567 2J

DAVYHULME STW, NORTH WEST WATER, ENGLAND.
Options Available for Ammonia Removal at Davyhulme Sewage-Treatment Works.
W91-05973 5D

DELAWARE UNIV., NEWARK. COLL. OF MARINE STUDIES.
Sea Level Variability in Long Island Sound.
W91-06833 2L

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING.
Peroxide Pre-Oxidation of Recalcitrant Toxic Waste to Enhance Biodegradation.
W91-06079 5D

Removal of Chlorophenols from Water by Photocatalytic Oxidation.
W91-06080 5F

Mechanistic Aspects of the Photocatalytic Oxidation of Phenol in Aqueous Solutions.
W91-06657 5D

DELTA INST. FOR HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).
Relationship Between PCB Concentrations and Reproduction in Mussels Mytilus edulis.
W91-06390 5C

DEMOCRITOS NUCLEAR RESEARCH CENTER, ATHENS (GREECE).
Geochemical Partitioning of Co, Cr, Fe, Sc, and Zn in Polluted and Non-Polluted Marine Sediments.
W91-06805 5B

DEPARTMENT OF ENERGY, WEST VALLEY, NY. WEST VALLEY DEMONSTRATION PROJECT.
Strategy for Management of Mixed Wastes at the West Valley Demonstration Project.
W91-06150 5E

DEPARTMENT OF FISHERIES AND OCEANS, BURLINGTON (ONTARIO).
Review of Biochemical Methods and Other Indicators to Assess Fish Health in Aquatic Ecosystems Containing Toxic Chemicals.
W91-06920 5A

DEPARTMENT OF FISHERIES AND OCEANS, ST. JOHN'S (NEWFOUNDLAND). SCIENCE BRANCH.
Effect of Polycyclic Aromatic Hydrocarbons on Immune Responses in Fish: Change in Melano-macrophage Centers in Flounder (Pseudopleuronectes americanus) Exposed to Hydrocarbon-Contaminated Sediments.
W91-06381 5C

DEPARTMENT OF PHYSICAL OCEANOGRAPHY AND MARINE METEOROLOGY, OCEAN UNIVERSITY OF QINGDAO, QINGDAO, CHINA.
Nonlinear Tidal Waves in a Kind of Estuary with Gradually Varying Cross-Section.
W91-06099 2L

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, HAMILTON (NEW ZEALAND). WATER QUALITY CENTRE.
Variation in Composition and Condition of the Pacific Oyster, Crassostrea gigas, Along a Pollution Gradient in Manukau Harbour, New Zealand.
W91-06261 5C

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, LOWER HUTT (NEW ZEALAND). DIV. OF LAND AND SOIL SCIENCES.
Effect of Different Drainage Systems on Bearing Resistance of Some West Coast, South Island Soils.
W91-06937 2G

DOBROCKY SEATECH LTD., SIDNEY (BRITISH COLUMBIA).
Experimental Marine Ecosystem Study of the Pelagic Biogeochemistry of Pentachlorophenol.
W91-06241 5B

DOW CHEMICAL CO., MIDLAND, MI. ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY RESEARCH LAB.
Sensitivity of Two Cladocerans to Water Quality Variables: Salinity and Hardness.
W91-06762 5C

DOW CHEMICAL U.S.A., MIDLAND, MI.
Waste Reduction for Chlorinated Solvents Users.
W91-06685 5D

DREXEL UNIV., PHILADELPHIA, PA. DEPT. OF CIVIL ENGINEERING.
Microbiological Methods and Monitoring of Drinking Water.
W91-06215 5A

DU PONT DE NEMOURS (E.I.) AND CO., NEWARK, DE. ENGINEERING DEPT.
Tyvek Microfiltration of Hazardous Wastewaters.
W91-06431 5D

Waste Minimization and Recycling with Membrane Filter Presses.
W91-06459 5D

DU PONT DE NEMOURS (E.I.) AND CO., PHILADELPHIA, PA. MARSHALL LABS.
Large-Scale Demonstration of Low-Level Waste Solidification in Saltstone.
W91-06155 5E

DU PONT DE NEMOURS (E.I.) AND CO., WILMINGTON, DE. AGRICULTURAL PRODUCTS DEPT.
Effect of Moisture on Chlorimuron Degradation in Soil.
W91-06988 5B

DUKE UNIV., DURHAM, NC. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Channelling and the Doubly Concave Flux Curve in Batch Thickening.
W91-06422 5D

DUPHAR B.V., THE HAGUE (NETHERLANDS). CROP PROTECTION DIV.
Degradation of Diflubenzuron and Its Chief Metabolites in Soils Part III: Fate of 2,6-Difluorobenzoic Acid.
W91-06792 5B

DURBAN-WESTVILLE UNIV. (SOUTH AFRICA). DEPT. OF BOTANY.
Litter Production by Mangroves: III. Wavecrest (Transkei) with Predictions for Other Transkei Estuaries.
W91-06289 2L

E.V.S. CONSULTANTS LTD., NORTH VANCOUVER (BRITISH COLUMBIA).
Acute Avoidance Reactions and Behavioral Responses of Juvenile Rainbow Trout (Oncorhynchus mykiss) to Garlon 4, Garlon 3A and Vision Herbicides.
W91-06997 5C

EA NORTHWEST OPERATIONS, REDMONT, WA.
Boundary Shear Stress and Roughness over Mobile Alluvial Beds.
W91-07031 2J

EARTH TECHNOLOGY CORP., ALEXANDRIA, VA.
Minimizing Waste Oil Disposal.
W91-06168 5E

EAST BAY MUNICIPAL UTILITY DISTRICT, OAKLAND, CA.
Performance and Analysis of Tracer Tests to Determine Compliance of a Disinfection Scheme with the SWTR.
W91-05965 5F

EASTERN NEW MEXICO UNIV., PORTALES. DEPT. OF LIFE SCIENCES.
Temperature Preference versus Acclimation in Fishes: Selection for Changing Metabolic Optima.
W91-06036 2H

EASTERN WASHINGTON UNIV., CHENEY. ARCHAEOLOGICAL AND HISTORICAL SERVICES.
Report on Archaeological Testing at Salishan Mesa (45GR445), Grant County, Washington.
W91-07038 6G

Archaeological Investigations at River Mile 590: The Excavations at 45DO189.
W91-07039 6G

EBASCO SERVICES, INC., CHICAGO, IL.
Solid/Liquid Separation in Waste Acid Neutralization: A Case Study.
W91-06434 5D

ECONOMIC RESEARCH SERVICE, WASHINGTON, DC. COMMODITY ECONOMICS DIV.
Costs and Benefits of the Conservation Reserve Program.
W91-06273 4D

EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERREINIGUNG UND GEWAESSERSCHULTZ, DUEBENDORF (SWITZERLAND).
Organotin Speciation in Municipal Wastewater and Sewage Sludge: Ecotoxicological Consequences.
W91-06388 5B

ELECTRO-PURE SYSTEMS, INC., AMHERST, NY.
Solid/Liquid Separation Using Alternating Current Electrocoagulation.
W91-06454 5D

ELETROBRAS, RIO DE JANEIRO (BRAZIL). DEPT. DE RECURSOS ENERGETICOS.
Sediment Yield in the Velhas River Basin (Minas Gerais, Brazil).
W91-07097 2J

ENEA, ROME (ITALY). NUCLEAR FUEL CYCLE DIV.
Characterization and Control of Solidified Radioactive Wastes According to the Italian Rules: Organization of a Characterization Facility and First Results.
W91-06133 5E

ENERGY ANSWERS CORP., ALBANY, NY.
Utilization of Ash Products from Combustion of Shredded Solid Waste.
W91-06175 5E

ENGE-RIO, ENGENHARIA E CONSULTORIA S/A, DEPARTAMENTO ENGENHARIA CIVIL, SETOR COMERCIAL NORTE, QUADRA 6, CONJ. A, SUPER CENTER VENANCIO 3000, SALA 601, B1.A, BRASILIA/DF, CEP: 70710, BRAZIL.
Analytical Evaluation of Bed Load Transport in a River Subject to Backwater Effect: The Case of the River Trombetas.
W91-07072 2J

ENVIRONMENT CANADA, OTTAWA (ONTARIO). WATER RESOURCES BRANCH.
Evaluation of Long Term Suspended Sediment Records for Selected Canadian Rivers.
W91-07078 2J

ENVIRONMENTAL LAW INST., WASHINGTON, DC.
Swampbuster Implementation: Missed Opportunities for Wetland Protection.
W91-06274 6E

ENVIRONMENTAL PROTECTION AGENCY, CHICAGO, IL. GREAT LAKES NATIONAL PROGRAM OFFICE.
Observations on Fish Community Health.
W91-06930 5A

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH.
Microbiological Quality of Source Waters for Water Supply.
W91-06195 5F

Microbiology and Drinking Water Filtration.
W91-06200 5F

Home Treatment Devices and Water Quality.
W91-06201 5F

Overview of Separation Technologies Demonstrated by the EPA's Superfund Innovative Technology Evaluation (SITE) Program.
W91-06437 5D

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. DRINKING WATER RESEARCH DIV.
Characterizing Surface Waters That May Not Require Filtration.
W91-05959 2H

Monitoring Heterotrophic Bacteria in Potable Water.
W91-06216 5A

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE.
Solvent Waste Reduction.
W91-06678 5D

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. HAZARDOUS WASTE ENGINEERING RESEARCH LAB.
Hazardous Waste Volume Reduction Research in the U.S. Environmental Protection Agency.
W91-06172 5E

ENVIRONMENTAL PROTECTION AGENCY, NARRAGANSETT, RI.
Role of the Red Gland in Mercenaria mercenaria in Detoxification.
W91-06384 5B

ENVIRONMENTAL PROTECTION AGENCY, NARRAGANSETT, RI. ENVIRONMENTAL RESEARCH LAB.
Comparison of Both Neoplastic and Non-Neoplastic Disorders in Winter Flounder (Pseudopleuronectes americanus) from Eight Areas in New England.
W91-06375 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. NONPOINT SOURCES BRANCH.
Reducing Agricultural Pesticide Use in Sweden.
W91-06229 5G

Low-Input Agriculture Reduces Nonpoint-Source Pollution.
W91-06304 5G

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF EMERGENCY AND REMEDIAL RESPONSE.
Evaluating the Effectiveness of Ground Water Extraction Systems.
W91-06852 5G

Superfund Record of Decision: United Scrap Lead, OH.
W91-07051 5G

Superfund Record of Decision: Ringwood Mines/Landfill, VA.
W91-07054 5G

Superfund Record of Decision: Upjohn Manufacturing Company, PR.
W91-07056 5G

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF SOLID WASTE.
Land and Liquid Disposal Bans.
W91-06679 5E

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF TOXIC SUBSTANCES.
Review of Chemical Fate Testing Conducted under Section 4 of the Toxic Substances Control Act: Chemicals, Tests, and Methods.
W91-06697 5B

ENVIRONMENTAL PROTECTION POLYMERS, INC., HAWTHORNE, CA.
Surface Encapsulation Process for Stabilizing Intractable Contaminants.
W91-06129 5E

ENVIRONMENTAL PROTECTION SERVICE, BURLINGTON (ONTARIO). WASTE WATER TECHNOLOGY CENTRE.
Activated Sludge Process Response to Variable Inputs of Volatile Organic Contaminants.
W91-06078 5D

ENVIRONMENTAL PROTECTION SERVICE, DARTMOUTH (NOVA SCOTIA).
Toxicity to Aquatic Organisms of Off-Target Deposition of Endosulfan Applied by Aircraft.
W91-07000 5C

ENVIRONMENTAL PROTECTION SERVICE, JERUSALEM (ISRAEL).
Review on the Small Hydrological Basins in Finland.
W91-06463 2E

ENVIRONMENTAL PROTECTION SERVICE, ST. JOHN'S (NEWFOUNDLAND).
Assessment of the Potential for Mixed-Function Oxygenase Enzyme Induction in the Extrahepatic Tissues of Cunners (Tautogolabrus adspersus) during Reproduction.
W91-06341 5A

ENVIRONMENTAL RESEARCH LAB.-DULUTH, MN.
Model for Exchange of Organic Chemicals at Fish Gills: Flow and Diffusion Limitations.
W91-06747 5B

Use of Respiratory-Cardiovascular Responses of Rainbow Trout (Oncorhynchus mykiss) in Identifying Acute Toxicity Syndromes in Fish: Part 4. Central Nervous System Seizure Agents.
W91-07001 5A

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FL.
Aquatic Test Systems for Studying the Fate of Xenobiotic Compounds.
W91-06694 5B

ENVIRONMENTAL RESEARCH LAB.-NARRAGANSETT, NEWPORT, OR. MARK O. HATFIELD MARINE SCIENCE CENTER.
Spatio-Temporal Fluctuations in the Distribution and Abundance of Demersal Fish and Epibenthic Crustaceans in Yaquina Bay, Oregon.
W91-06843 2L

Accumulation Factors for Eleven Polychlorinated Biphenyl Congeners.
W91-06894 5B

ENVIRONMENTAL RESEARCH LAB., NARRAGANSETT, RI.
Use of the Blue Mussel, Mytilus edulis, in Water Quality Toxicity Testing and In Situ Marine Biological Monitoring.
W91-06702 5A

ENVIRONMENTAL RESOURCES MANAGEMENT, INC., EXTON, PA.
Methods to Set Soil Cleanup Goals to Protect Surface and Ground Water Quality at Hazardous Waste Sites.
W91-06083 5G

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC., GAINESVILLE, FL.
Hazardous Waste Minimization Audits: Strategy and Methodology.
W91-06164 5E

ETON COLL., WINDSOR (ENGLAND). DEPT. OF GEOGRAPHY.
Incised Channel and Terrace Formation near Mount St. Helens, Washington.
W91-06627 2J

EXETER UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Some Applications of Caesium-137 in the Study of Erosion, Transport and Deposition.
W91-06730 2J

EXETER UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.

Effect of Selected Physiographic Factors on Dissolved Gypsum Transport by Simulated Runoff on Gypsiferous Soils.
W91-06909 2K

Use of Caesium-137 Measurements to Investigate Sediment Delivery from Cultivated Areas in Devon, UK.
W91-07093 2J

Reliability of Rating Curve Estimates of Suspended Sediment Yield: Some Further Comments.
W91-07094 2J

FACHHOCHSCHULE NORDOSTNIEDERSACHSEN, SUDERBURG (GERMANY, F.R.). DEPT. OF CIVIL ENGINEERING.

Regional Analysis of Flow Duration Curves.
W91-06484 2E

FACULTE DES SCIENCES AGRONOMIQUES DE L'ETAT, GEMBLOUX (BELGIUM). LAB. DE TELEDETECTION ET D'HYDRAULIQUE AGRICOLE.

Characterization of Watersheds by the Integration of Remote Sensing and Cartographic Digital Data.
W91-06477 2E

FISH AND WILDLIFE SERVICE, VERNAL, UT.

Fish Associations and Environmental Variables in Age-0 Colorado Squawfish Habitats, Green River, Utah.
W91-06013 2H

FLEXEL KANSAS, INC., TECUMSEH.

Elimination of Precoat Filter Sludge Hazardous Waste.
W91-06174 5D

FLORENCE UNIV. (ITALY). DIPT. DI SCIENZE DELLA TERRA.

Cropping Pattern and Its Role in Determining Erosion Risk: Experimental Plot Results from the Mugello Valley (Central Italy).
W91-07073 2J

FLORIDA INST. OF TECH., MELBOURNE. DEPT. OF CHEMICAL AND ENVIRONMENTAL ENGINEERING.

Energy Waste Stabilization Technology for Use in Artificial Reef Construction.
W91-06674 5E

FLORIDA STATE DEPT. OF ENVIRONMENTAL REGULATION, TALLAHASSEE. WATER SUPPLY SECTION.

Use of Membrane Technology in Florida.
W91-06809 3A

FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF METEOROLOGY.

Precipitation Prediction over the Tropics from a Global Spectral Model.
W91-06404 2B

FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF OCEANOGRAPHY.

Radium in the Suwannee River and Estuary: Spring and River Input to the Gulf of Mexico.
W91-06953 5B

FLORIDA UNIV., GAINESVILLE. DEPT. OF GEOGRAPHY.

Strategies for Sustainable Agriculture in the Tropics.
W91-06108 3F

FLORIDA UNIV., GAINESVILLE. DEPT. OF MATERIALS SCIENCE AND ENGINEERING.

Characterization of Flocs for Solid/Liquid Separation Processes.
W91-06438 5D

FLORIDA UNIV., GAINESVILLE. DEPT. OF SOIL SCIENCE.

Water Hyacinth Growth in Anaerobic Digester Effluents.
W91-06222 5D

FLORIDA UNIV., GAINESVILLE. INST. OF FOOD AND AGRICULTURAL SCIENCES.

Nitrogen Leaching from Cypress Wood Chips.
W91-06414 3F

FLORIDA UNIV., LAKE ALFRED. CITRUS EXPERIMENT STATION.

Differential Sorption of Herbicides as Related to Soil Topography and Organic Matter.
W91-06006 5B

FLUOR DANIEL, GREENVILLE, SC.

Use of Sediment Heavy Metal Bioavailability as a Method of Environmental Hazard Assessment.
W91-06699 5A

FMC CORP., PRINCETON, NJ. PEROXYGEN CHEMICAL DIV.

Supported Catalysts in Hazardous Waste Treatment: Destruction of Inorganic Pollutants in Wastewater with Hydrogen Peroxide.
W91-06659 5D

UV Destruction of Phenolic Compounds under Alkaline Conditions.
W91-06661 5D

FONDATION UNIV. LUXEMBORGEOISE, ARLON (BELGIUM).

Oxygen Transfer in Trickling Filters.
W91-06864 5D

FOREST AND FOREST PRODUCTS RESEARCH INST., KYOTO (JAPAN). KANSAI BRANCH.

Seasonal Variation of Radiation and Energy Balances in a Hinoki Stand.
W91-06543 2D

Analysis of Stormflow and its Source Area Expansion through a Simple Kinematic Wave Equation.
W91-06568 2E

FOREST PEST MANAGEMENT INST., SAULT SAINTE MARIE (ONTARIO).

Off-target Deposits and Buffer Zones Required around Water for Aerial Glyphosate Applications.
W91-06796 5G

FOREST RESEARCH INST., CHRISTCHURCH (NEW ZEALAND). FOREST AND WILDLAND ECOSYSTEMS DIV.

Chemical Composition of Soil Solutions Extracted from New Zealand Beech Forests and West German Beech and Spruce Forests.
W91-06316 5B

Hydrology of an Acid Wetland before and after Draining for Afforestation, Western New Zealand.
W91-06553 4C

Reforestation: On-Site Effects on Hydrology and Erosion, Eastern Raukumara Range, New Zealand.
W91-06556 4A

FOREST SERVICE, ARCADIA, CA.

Subsurface Pipeflow Dynamics of North-Coastal California Swale Systems.
W91-06577 2J

FOREST SERVICE, FORT COLLINS, CO.

Effect of Clearcutting on Chemical Exports in Lateral Flow from Differing Soil Depths on a Subalpine Forested Slope.
W91-06550 4C

Effect of Clearcutting on Streamflow Generating Processes from a Subalpine Forest Slope.
W91-06562 4C

FOREST SERVICE, LOGAN, UT. INTERMOUNTAIN RESEARCH STATION.

Dynamic Model of Slope Stability in Zero-Order Basins.
W91-06580 2J

FREIBURG UNIV. (GERMANY, F.R.). INST. FUER BIOLOGIE 2.

Periplasmic and Intracytoplasmic Polyphosphate and Easily Washable Phosphate in Pure Cultures of Sewage Bacteria.
W91-06858 5D

FREIBURG UNIV. (GERMANY, F.R.). INST. FUER PHYSISCHE GEOGRAPHIE.

Application of the West German IHP Recommendations for the Analysis of Data from Small Research Basins.
W91-06467 2E

FREIE UNIV. BERLIN (GERMANY, F.R.). INST. FUER PHYSISCHE GEOGRAPHIE.

New Developments in Measuring Bed Load by the Magnetic Tracer Technique.
W91-06729 7B

Nature of Coarse Material Bed Load Transport.
W91-07080 2J

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).

Lichenometric Dating Applied to Flood Deposits.
W91-06630 7C

FRUEHAUF CORP., DETROIT, MI.

Waste Oil Management for a Small Quantity Generator.
W91-06170 5E

FUNDACAO CENTRO TECNOLOGICO DE MINAS GERAIS (BRAZIL).

Average Long-Term Sediment Discharge Investigations Based on Reservoir Resurvey Data and Sediment Yield Rate Factors.
W91-07102 2J

GENERAL MOTORS RESEARCH LABS., WARREN, MI. ENVIRONMENTAL SCIENCE DEPT.

Ambient Concentrations, Scavenging Ratios, and Source Regions of Acid Related Compounds and Trace Metals During Winter in Northern Michigan.
W91-06875 5B

GENEVA UNIV. (SWITZERLAND). DEPT. DE CHIMIE MINERALE, ANALYTIQUE ET APPLIQUEE.

In Situ Voltammetric Measurement of Trace Elements in Lakes and Oceans.
W91-07016 5A

GEOFAX B.V., OLDENZAAL (NETHERLANDS).

Applications of Remote Sensing Techniques for the Inventory and Monitoring of Environmental Pollution.
W91-07052 7B

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.

Geohydrology and Simulation of Ground-Water Flow in the'400-Foot,' '600-Foot,' and Adjacent Aquifers, Baton Rouge Area, Louisiana.
W91-07047 2F

GEOLOGICAL SURVEY, BOW, NH. WATER RESOURCES DIV.
Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.
W91-07050 2F

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Traveltime and Reaeration Coefficients for the North Platte River, Casper to Orin, Wyoming.
W91-07042 2E

GEOLOGICAL SURVEY, DENVER, CO.
Uncertainties in Defining the Suspended Sediment Budget for Large Drainage Basins.
W91-07111 2J

GEOLOGICAL SURVEY, DORAVILLE, GA.
Sources of Acidity during Snowmelt at a Forested Site in the West-Central Adirondack Mountains, New York.
W91-06519 5B

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Surface-Water Quality in the West Branch Susquehanna River Basin, Pennsylvania: An Appraisal of Areal and Temporal Variability from 1962 to 1982 in Hydrologic Accounting Unit 020502.
W91-07043 5G

GEOLOGICAL SURVEY, MENLO PARK, CA.
Mobilization of Debris Flows from Shallow Slides.
W91-06597 2J

Bankfull Discharge and Sediment Transport in Northwestern California.
W91-06643 2E

Landslide Erosion in Central Santa Cruz Mountains, California, USA.
W91-06648 2J

GEOLOGICAL SURVEY, MENLO PARK, CA. BRANCH OF GEOLOGIC RISK ASSESSMENT.
Zero-Order Basins Shaped by Debris Flows, Sunol, California, USA.
W91-06581 2J

GEOLOGICAL SURVEY, MERCURY, NV. WATER RESOURCES DIV.
Effect of Surrounding Topography on Receipt of Solar Radiation.
W91-06542 2I

GEOLOGICAL SURVEY, NASHVILLE, TN.
Geomorphic and Vegetative Recovery Processes along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems.
W91-06534 4A

GEOLOGICAL SURVEY, RESTON, VA.
Light Attenuation and Submersed Macrophyte Distribution in Tidal Potomac River and Estuary.
W91-06840 2L

GEOLOGICAL SURVEY, STENNIS SPACE CENTER, MS.
Use of a Standpipe to Evaluate Ground Water Samplers.
W91-06853 7B

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Sediment Transport in the Lower Puyallup, White, and Carbon Rivers of Western Washington.
W91-07045 2J

GEOLOGICAL SURVEY, TAMPA, FL.
Radium and Radon in Charlotte Harbor Estuary, Florida.
W91-06770 5B

GEOLOGICAL SURVEY, TOWSON, MD.
Application of Marine Seismic Profiling to a Ground Water Contamination Study, Aberdeen Proving Ground, Maryland.
W91-06849 5B

GEOLOGICAL SURVEY, TUCSON, AZ.
William A. Cannon: The Sonoran Desert's First Resident Ecologist.
W91-06008 6G

GEORGIA INST. OF TECH., ATLANTA.
Emerging Technologies in Hazardous Waste Management.
W91-06655 5G

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CHEMICAL ENGINEERING.
Emerging Technologies for Hazardous Waste Management: An Overview.
W91-06656 5D

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CIVIL ENGINEERING.
Factors Influencing Mobility of Toxic Metals in Landfills Operated with Leachate Recycle.
W91-06671 5E

Sorptive Behavior of Selected Organic Pollutants Codisposed in a Municipal Landfill.
W91-06672 5E

GEORGIA TECH RESEARCH CORP., ATLANTA.
Nutrient Needs.
W91-06398 3F

GEORGIA UNIV., ATHENS. DEPT. OF AGRICULTURAL ECONOMICS.
Economic Value of Wetlands-Based Recreation.
W91-06831 6B

GEORGIA UNIV., ATHENS. DEPT. OF AGRONOMY.
Dissipation of Flurtamone in Three Georgia Soils.
W91-06828 5B

GEORGIA UNIV., ATHENS. DEPT. OF ENTOMOLOGY.
Secondary Production of Chironomid Communities in Insecticide-Treated and Untreated Headwater Streams.
W91-06268 5C

GEORGIA UNIV., ATHENS. DEPT. OF MICROBIOLOGY.
Degradation of 2,4-Dichlorophenol in Anaerobic Freshwater Lake Sediments.
W91-06663 5G

GEORGIA UNIV., ATHENS. INST. OF ECOLOGY.
Resource Quality and Trophic Responses to Simulated Throughfall: Effects on Decomposition and Nutrient Flux in a No-Tillage Agroecosystem.
W91-06967 3F

GEORGIA UNIV., ATHENS. SCHOOL OF ENVIRONMENTAL DESIGN.
Urban Stormwater Infiltration: Purposes, Implementation, Results.
W91-06228 5E

GEORGIA UNIV., SAPELO ISLAND. MARINE INST.
Intertidal Distribution and Feeding Habits of the Mud Crab, Eurytium limosum.
W91-06842 2L

GERAGHTY AND MILLER, INC., TAMPA, FL.
Evaluation of Ultraviolet (UV)-Oxidation Treatment Methods.
W91-06847 5D

GESAMTHOCHSCHULE PADERBORN (GERMANY, F.R.). FACHBEREICH 13 - CHEMIE UND CHEMIETECHNIK.
Sand and Activated Carbon as Biofilm Carriers for Microbial Degradation of Phenols and Nitrogen-Containing Aromatic Compounds.
W91-06857 5D

GESELLSCHAFT FUER STRAHLEN- UND UMWELTFORSCHUNG M.B.H. MUENCHEN, NEUHERBERG (GERMANY, F.R.). INST. FUER OEKOLOGISCHE CHEMIE.
Fate of (C-14)Monolinuron in Potatoes and Soil under Outdoor Conditions.
W91-05997 5B

GESELLSCHAFT FUER SYSTEMFORSCHUNG UND UMWELPLANUNG MBH, RINGSTRASSE 6, D-8041 KRANZBERG, GERMANY.
Combining a Modified Universal Soil Loss Equation with a Digital Terrain Model for Computing High Resolution Maps of Soil Loss Resulting from Rain Wash.
W91-06907 2J

GOETEBORG UNIV. (SWEDEN). DEPT. OF ZOOPHYSIOLOGY.
Benzo(a)pyrene Metabolism in Isolated Perfused Rainbow Trout Gills.
W91-06324 5B

Induction of Xenobiotic Metabolizing Enzyme Activities in Primary Culture of Rainbow Trout Hepatocytes.
W91-06340 5C

Relationship Between Metallothionein, Copper and Zinc in Perch (Perca fluviatilis) Environmentally Exposed to Heavy Metals.
W91-06348 5B

Induction of Metallothionein by Cadmium in Bluestriped Grunt (Haemulon sciurus).
W91-06349 5A

GOSUDARSTVENNYI GIDROLOGICHESKII INST., LENINGRAD (USSR).
Possibility of Mathematical Model Application to Evaluate Man's Activity Effects on Rainfall Runoff Hydrograph.
W91-06493 2E

GOSUDARSTVENNYI GIDROLOGICHESKII INST., VALDAI (USSR).
Permeability of Frozen and Thawed Soils and Sub-Soils During Spring Snowmelt Flood.
W91-06465 2C

Forest Cut and Forest Regeneration Effects on Water Balance and River Runoff.
W91-06490 2E

GREAT LAKES FORESTRY RESEARCH CENTRE, SAULT SAINTE MARIE (ONTARIO).
Contributions of Acid Deposition to Streamwater Chemistry in Three Precambrian Shield Basins.
W91-06518 5B

GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF PHYSICAL GEOGRAPHY.
Modelling Forest Transpiration from Climatological Data.
W91-06540 2D

GUELPH UNIV. (ONTARIO). DEPT. OF ENVIRONMENTAL BIOLOGY.

GUELPH UNIV. (ONTARIO). DEPT. OF ENVIRONMENTAL BIOLOGY.
Acute Toxicity of Pure Pentachlorophenol and a Technical Formulation to Three Species of Daphnia.
W91-06776 5C

Immunoassays to Detect and Quantitate Herbicides in the Environment.
W91-06990 5A

GUELPH UNIV. (ONTARIO). DEPT. OF LAND RESOURCE SCIENCE.
Influence of Aggregate Diameter, Surface Area and Antecedent Water Content on the Dispersibility of Clay.
W91-06407 2G

Denitrification with Different Sizes of Soil Aggregates Obtained from Dry-Sieving and from Sieving with Water.
W91-06787 2G

GUELPH UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
Abundance and Biomass of Herbivorous Zooplankton off Kingston, Jamaica, with Estimates of their Annual Production.
W91-06769 2L

GUELPH UNIV. (ONTARIO). SCHOOL OF ENGINEERING.
Corrected Method for Dry Matter Determination for Use in Anaerobic Digester Control.
W91-06223 5D

GUJARAT WATER RESOURCES DEPT., GANDHINAGAR (INDIA).
Environmental Effects of the Mahi-Kadana and Dharoi Projects at Gujarat, India.
W91-06903 6G

GULF COAST RESEARCH AND EDUCATION CENTER, BRADENTON, FL.
Measurement of Soil Water Potential.
W91-06415 2G

HACH CO., LOVELAND, CO.
Ten-Minute Digestion.
W91-06429 5D

HAIFA UNIV. (ISRAEL). DEPT. OF GEOGRAPHY.
Hydrological Regime and Fluvial Processes in Basaltic Mountainous Areas.
W91-06632 2E

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION, INC., FORT PIERCE, FL.
Nutrient Couplings between On-Site Sewage Disposal Systems, Groundwaters, and Nearshore Surface Waters of the Florida Keys.
W91-06956 5B

HAWAII UNIV. AT MANOA, HONOLULU. DEPT. OF AGRONOMY AND SOIL SCIENCE.
Field Movement and Persistence of Fenamiphos in Drip-Irrigated Pineapple Soils.
W91-06797 5B

HAWAII UNIV., HONOLULU. DEPT. OF AGRICULTURAL BIOCHEMISTRY.
Fate of Ethylenethiourea in Hawaiian Soil and Water.
W91-06959 5B

HEBREW UNIV. OF JERUSALEM (ISRAEL). CASALI INST. OF APPLIED CHEMISTRY.
New Approach for Treatment of Acid-Containing Waste Streams.
W91-06668 5D

HEBREW UNIV. OF JERUSALEM (ISRAEL). DIV. OF ENVIRONMENTAL SCIENCES.
Detection of Human Rotaviruses in Fresh and Estuarine Waters by Dot-Blot Hybridization.
W91-06067 5A

HIROSHIMA UNIV. (JAPAN). FACULTY OF APPLIED BIOLOGICAL SCIENCE.
Bioconcentration of Endosulfan in Different Body Tissues of Estuarine Organisms under Sublethal Exposure.
W91-05989 5C

Effect of Phosphorus on Drought Tolerance in Chloris gayana Kunth and Coix lacryma-jobi L.
W91-06974 3F

HOKKAIDO NATIONAL AGRICULTURAL EXPERIMENT STATION, SAPPORO (JAPAN). PEAT SOIL LAB.
Chemical Properties of Subsurface Peats and Their Decomposition Kinetics under Field Conditions.
W91-06969 2K

HOKKAIDO UNIV., SAPPORO (JAPAN). DEPT. OF FORESTRY.
Influence of River Channel Morphology and Sediment Production on Residence Time and Transport Distance.
W91-06622 2J

HOKKAIDO UNIV., SAPPORO (JAPAN). FACULTY OF AGRICULTURE.
Toposequence of Fine-Textured Soils in the Hilly Area of the Northernmost Part of Hokkaido: III. Importance of Chelating Low Molecular Organic Acids in the Migration Process of Aluminum and Iron.
W91-06972 2K

Toposequence of Fine-Textured Soils in the Hilly Area of Northernmost Hokkaido: IV. Hydrolytic Reaction of Aluminum in the Presence of Oxalic of Citric Acid Ligands.
W91-06976 2K

HOLLANDSE EILANDENEN WAARDEN WASTEWATER AUTHORITY, DORDRECHT (NETHERLANDS).
State of Wastewater Treatment Industry in The Netherlands.
W91-06427 5D

HONG KONG ENVIRONMENTAL PROTECTION DEPT., WAN CHAI.
Epidemiological Study of Beach Water Pollution and Health-Related Bathing Water Standards in Hong Kong.
W91-06066 5A

HONG KONG ENVIRONMENTAL PROTECTION DEPT., WAN CHAI. WATER POLICY GROUP.
Water Quality in the Priority Watercourses of Hong Kong in Respect of Various Environmental Control Measures.
W91-06048 5G

HONG KONG POLYTECHNIC, KOWLOON. DEPT. OF CIVIL AND STRUCTURAL ENGINEERING.
Upgrading an Aerated Lagoon to a Sequencing Batch Reactor for Piggery Waste Treatment.
W91-06224 5D

HONG KONG UNIV. DEPT. OF CIVIL ENGINEERING.
Spatial and Temporal Variation of Rainfall and Runoff in Hong Kong.
W91-06501 2B

HONG KONG UNIV. DEPT. OF GEOGRAPHY AND GEOLOGY.
Techniques for Establishing Suspended Sediment Sources in Two Drainage Basins in Devon, UK: A Comparative Assessment.
W91-07087 2J

HOOGHEEMRAADSCHAP VAN RIJNLAND, LEIDEN (NETHERLANDS).
Rhineland on the Way to Its Thousandth Anniversary or Water-Administration in the Next 100-200 Years.
W91-06044 6E

HOUSTON UNIV., TX. DEPT. OF CHEMISTRY.
Concentration of Organics from Aqueous Solutions Using Uncoated Capillary Columns.
W91-07012 5A

HOWARD UNIV., WASHINGTON, DC. DEPT. OF CHEMICAL ENGINEERING.
In-Situ Treatment of Soils Contaminated with Hazardous Organic Wastes Using Surfactants: A Critical Analysis.
W91-06445 5G

HOWARD UNIV., WASHINGTON, DC. SCHOOL OF ENGINEERING.
Recovery of Organic Compounds from Sewage Sludge by Proton Transfer.
W91-06673 5D

HUMBOLDT STATE UNIV., ARCATA, CA. DEPT. OF GEOLOGY.
Bedrock Geometry of Unchannelized Valleys.
W91-06578 2J

Rates of Soil Creep on Colluvium-Mantled Hillslopes in North-Central California.
W91-06579 2J

HUMBOLDT STATE UNIV., ARCATA, CA. DEPT. OF WATERSHED MANAGEMENT.
Response of a Northern California Coastal Drainage Basin to Land Use Disturbance.
W91-06651 2J

HUMBOLDT-UNIV. ZU BERLIN (GERMAN D.R.). SEKTION PHYSIK.
Use of Lysimeter Measurements for Estimation of the Evapotranspiration of Pine Forest by Bagrov's Method.
W91-06544 2D

HYDRAULIC ADMINISTRATION, AVENUE HASSAN BEN CHEKROUN, CASIER RABAT CHELLAH, MOROCCO.
Silting of Moroccan Dams.
W91-07065 2J

HYDRAULICS RESEARCH LTD., WALLINGFORD (ENGLAND). OVERSEAS DEVELOPMENT UNIT.
Sediment Yield and Availability for Two Reservoir Drainage Basins in Central Luzon, Philippines.
W91-07116 2J

HYDROCONSULT A.B., UPPSALA (SWEDEN).
Aspects of Hydrological Interpolation with the Help of GIS.
W91-06476 2E

IBADAN UNIV. (NIGERIA). DEPT. OF ZOOLOGY.
Production and Population Dynamics of Pachymelania aurita Muller.
W91-06757 2L

IDAHO DIV. OF ENVIRONMENTAL QUALITY, COEUR D'ALENE.
Evaluating the Performance of Slow Sand Filters in Northern Idaho.
W91-05960 5F

IDAHO NATIONAL ENGINEERING LAB., IDAHO FALLS. BIOTECHNOLOGY AND WASTE MANAGEMENT PROGRAMS.
Field Testing of Waste Forms Using Lysimeters.
W91-06156 5E

IDAHO NATIONAL ENGINEERING LAB., IDAHO FALLS. WASTE ENGINEERING DEVELOPMENT UNIT.
Stabilization of Mixed Waste at the Idaho National Engineering Laboratory.
W91-06152 5E

IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ECONOMICS.
Effective Cost-Share Rates and the Distribution of Social Costs in the Rock Creek, Idaho, Rural Clean Water Project.
W91-06116 6C

ILLINOIS INST. OF TECH., CHICAGO.
Statistical Approaches to Monitoring.
W91-06214 5A

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN.
Sedimentation of Four Reaches of the Mississippi and Illinois Rivers.
W91-07059 2J

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN. AQUATIC CHEMISTRY SECTION.
Modeling Advanced Oxidation Processes for Water Treatment.
W91-06662 5D

ILLINOIS UNIV. AT CHICAGO CIRCLE. DEPT. OF BIOLOGICAL SCIENCES.
Oxidative Dehydrochlorination of Heptachlor by Daphnia magna.
W91-07002 5B

ILLINOIS UNIV. AT CHICAGO CIRCLE. DEPT. OF GEOLOGICAL SCIENCES.
Sediment Transport and Deposition Zones in Braided Streams.
W91-06638 2J

Hydrological Characteristics as a Determinant of Sediment Delivery in Watersheds.
W91-07067 2J

Morphological Controls on Sediment Delivery Pathways.
W91-07112 2J

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
Analyzing Biofilm Processes Used in Biological Filtration.
W91-05961 5F

Ultrafiltration of Lake Water: Effect of Pretreatment on the Partitioning of Organics, THMFP, and Flux.
W91-05964 5F

Dam Safety Inspection Scheduling.
W91-06295 8G

ILLINOIS UNIV., URBANA. DEPT. OF AGRICULTURAL ENGINEERING.
Apparent Geographic and Atmospheric Influences on Raindrop Sizes and Rainfall Kinetic Energy.
W91-06235 2B

ILLINOIS UNIV., URBANA. DEPT. OF CIVIL ENGINEERING.
Advancements in Toxicity Testing Applied to Design and Control of Biological Processes.
W91-06069 5D

Effects of Ultrafiltration Membrane Composition.
W91-06812 5F

ILLINOIS UNIV., URBANA. DEPT. OF FORESTRY.
Analysis of Sulfur in Soil, Plant and Sediment Materials: Sample Handling and Use of an Automated Analyzer.
W91-06960 5A

IMC FERTILIZER, INC., MULBERRY, FL.
Total Recycling of Wastewater in Wet Process Phosphoric Acid Production.
W91-06436 5D

IMPERIAL CHEMICAL INDUSTRIES LTD., ALDERLEY PARK (ENGLAND). CENTRAL TOXICOLOGY LAB.
Histopathological Assessment of Neurotoxic Injury in Mammals: Possible Applications for Similar Studies in Fish.
W91-06382 5A

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
Determination of Hydrological Flow Paths and Associated Hydrochemistry in Forested Catchments in Central Scotland.
W91-06551 5B

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Application of Time-series Modelling to Short-term Streamwater Acidification in Upland Scotland.
W91-06517 5B

IMPERIAL COLL. OF SCIENCE, TECHNOLOGY AND MEDICINE, LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.,
Use of Activated Charcoal and Tetra-Alkylammonium-Substituted Clays in Cement-Based Stabilization/Solidification of Phenols and Chlorinated Phenols.
W91-06147 5E

INDIAN INST. OF TECH., KANPUR. DEPT. OF CIVIL ENGINEERING.
Domestic Water Treatment for Developing Countries.
W91-06202 5F

INLAND WATERS DIRECTORATE, BURLINGTON (ONTARIO). WATER PLANNING AND MANAGEMENT BRANCH.
Water Demand Management: An Evaluation of a 'Soft' Solution for the Hamilton Harbour Remedial Action Plan.
W91-06050 5G

INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES, BARCELONA (SPAIN).
HCO3(-) as an Exogenous Carbon Source for Ruppia cirrhosa (Pentagna) Grande.
W91-06756 2H

INSTITUT DE RECHERCHE ET D'ETUDE D'HYDROTECHNIQUE ET D'AMELIORATION, 136 RUE '9 SEPTEMBRE,' 1618 SOFIA, BULGARIA.
General Relation for the Limiting Equilibrium State for Mobile Non-coherent Beds (Expression Generale du Debut d'Erosion d'un Fond Mobile Non-cohesif).
W91-07064 2J

INSTITUT FRANCAIS DE RECHERCHE SCIENTIFIQUE POUR LE DEVELOPPEMENT EN COOPERATION, LA PAZ (BOLIVIA). MISSION ORSTOM EN BOLIVIE.
Sediment Discharge from the Andes to the Amazonia along the Beni River (Exportation de Matieres en Suspension des Andes vers l'Amazonie par le Rio Beni, Bolivie).
W91-07104 2J

INSTITUT FRANCAIS DE RECHERCHE SCIENTIFIQUE POUR LE DEVELOPPEMENT EN COOPERATION, MONTPELLIER. CENTRE DE MONTPELLIER.
Transport of Suspended and Dissolved Matter in Large Rivers in Intertropical Regions: Preliminary Results in the Basin of the River Congo (Transport de Matiere sur les Grands Fleuves des Regions Intertropicales: Les Premiers Resultats des Mesures de Flux Particulaires sur le Bassin du Fleuve Congo).
W91-07110 2J

INSTITUT MAURICE-LAMONTAGNE, MONT-JOLI (QUEBEC).
Fish Community Health Assessment: A Useful Concept.
W91-06927 5A

INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE, RIMOUSKI (QUEBEC). CENTRE D'OCEANOLOGIA.
Seasonal Response of the Lower St Lawrence Estuary to Buoyancy Forcing by Regulated River Runoff.
W91-06765 2L

INSTITUT NATIONAL DE LA SANTE ET DE LA RECHERCHE MEDICALE, PARIS (FRANCE).
Effect of Selenium on the Uptake of Cadmium by the Marine Macroalga Hymenomonas (Cricosphaera) elongata.
W91-06386 5C

Effects of Starvation on Cadmium Uptake by a Marine Pseudomonad.
W91-06389 5B

INSTITUT RUDJER BOSKOVIC, ZAGREB (YUGOSLAVIA). CENTER FOR MARINE RESEARCH.
DNA Adducts in Marine Mussel Mytilus galloprovincialis Living in Polluted and Unpolluted Environments.
W91-06184 5C

DNA Adducts as Biomarkers in Genotoxic Risk Assessment in the Aquatic Environment.
W91-06367 5B

INSTITUTE FOR SOIL FERTILITY, HAREN (NETHERLANDS).
Heavy Metals and Organic Micropollutants in Floodplains of the River Waal, A Distributary of the River Rhine, 1958-1981.
W91-06936 5B

INSTITUTE OF APPLIED PHYSICS, PUSHKINO (USSR).
Effect of the Composition of Soil Solutions and Exchange Cations on Water Retention and Hydraulic Conductivity.
W91-05980 2G

INSTITUTE OF HYDROLOGY, BALQUHIDDER, LOCHEARNHEAD, SCOTLAND.
Changes in the Sediment Output of Two Upland Drainage Basins during Forestry Land Use Changes.
W91-07106 2J

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
FREND (Flow Regimes from Experimental and Network Data): The First One Hundred Days.
W91-06462 2E

Fitting Distributions to Annual Minimum Flows of Different Durations.
W91-06472 2E

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).

Application of Regional Flood Frequency Analysis to Basins in Northwest Europe.
W91-06479 2E

Regions Are Dead: Long Live the Regions: Methods of Identifying and Dispensing with Regions for Flood Frequency Analysis.
W91-06480 2E

Low Flow Regimes of Northern and Western Europe.
W91-06483 2E

Changing Frequency of Extreme Hydrological Events in Northern and Western Europe.
W91-06486 2E

Small Catchment Studies of Man's Impact on Flood Flows: Agricultural Drainage and Plantation Forestry.
W91-06491 2E

Application of a Lumped Conceptual Model to FREND Catchments.
W91-06492 2E

FREND Research Programme: Conclusions and Recommendations.
W91-06497 2E

Stream Head Migration: An Indicator of Runoff Processes on Chalklands.
W91-06908 2E

INSTITUTE OF MARINE ENVIRONMENTAL PROTECTION, DALIAN (CHINA).

Finite Element Model of Circulation In Shallow Water with Moving Boundary on Tidal-Flat.
W91-06218 2L

INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT, KATOWICE (POLAND).

Estimation of Changes of Runoff from Urbanized and Industrialized Catchment.
W91-06500 4C

INSTITUTE OF OCEAN SCIENCES, SIDNEY (BRITISH COLUMBIA).

High Cadmium Residues Observed During a Pilot Study in Shorebirds and Their Prey Downstream from the El Salvador Copper Mine, Chile.
W91-06893 5B

INSTITUTE OF OCEANOGRAPHY AND FISHERIES, ALEXANDRIA (EGYPT).

Formation of the Intermediate Water Masses Off the Egyptian Mediterranean Coast.
W91-06758 2L

INSTITUTE OF TECHNOLOGY, BAGHDAD (IRAQ). DEPT. OF IRRIGATION.

Unsteady Transport of Pollutants in Rivers Due to Pulse Disposal.
W91-06059 5B

INSTITUTE OF TERRESTRIAL ECOLOGY, BANGOR (WALES). BANGOR RESEARCH STATION.

Dissolved Inorganic Nitrogen Concentrations and Fluxes in Three British Sitka Spruce Plantations.
W91-06323 5B

Stream Acidification Resulting from Afforestation in the UK: Evaluation of Causes and Possible Ameliorative Measures.
W91-06516 5B

Growth Responses of Three Legume Species Exposed to Simulated Acid Rain.
W91-06804 5C

Effect of Harvest Intensity and Ground Flora Establishment on Inorganic-N Leaching from a Sitka Spruce Plantation in North Wales, UK.
W91-06945 4C

INSTITUTO DE CIENCIAS DEL MAR, BARCELONA (SPAIN).

Development of a Toxic Alexandrium minutum Halim (Dinophyceae) Bloom in the Harbour of Sant Carles de la Rapita (Ebro Delta, Northwestern Mediterranean).
W91-06938 5B

INSTITUTO DE INVESTIGACIONES MARINAS, VIGO (SPAIN).

Water Interchange Between the Ria of Vigo and the Coastal Shelf.
W91-06940 2L

INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS (BRAZIL).

Ratios of Eddy Transfer Coefficients over the Amazon Forest.
W91-06545 2D

INSTITUTO DE PESQUISAS HIDRAULICAS, PORTO ALEGRE (BRAZIL).

Rain and Urban Stormwater Quality.
W91-06053 5B

INSTITUTO DE RADIOPROTECAO E DOSIMETRIA, RIO DE JANEIRO (BRAZIL).

Cesium-137 In the Goiania Waterways During and After the Radiological Accident.
W91-06243 5B

INSTITUTO NACIONAL DE INVESTIGACIONES GEOLOGICO-MINERAS, BOGOTA (COLOMBIA).

Rapid Formation of Large Coastal Sand Bodies After Emplacement of Magdalena River Jetties, Northern Colombia.
W91-06800 2J

INSTITUTO NACIONAL DE LIMNOLOGIA, SANTO TOME (ARGENTINA).

Suspended Sediment at a Cross Section of the Middle Parana River: Concentration, Granulometry and Influence of the Main Tributaries.
W91-07099 2J

INSTITUTO PIRENAICO DE ECOLOGIA, JACA (SPAIN).

Assessing Sediment Sources in a Small Drainage Basin above the Timberline in the Pyrenees.
W91-07079 2J

INSTITUTO POLITECNICO NACIONAL, MEXICO CITY. DEPT. DE FARMACOLOGIA Y TOXICOLGIA.

Effects of Paraquat and Lead on Fish Oreochromis hornorum.
W91-06892 5C

INSTITUTO VENEZOLANO DE INVESTIGACIONES CIENTIFICAS, CARACAS. CENTRO DE ECOLOGIA Y CIENCIAS AMBIENTALES.

Aluminum Tolerance in Trees of a Tropical Cloud Forest.
W91-06310 5C

INSTITUTUL DE METEOROLOGIE SI HIDROLOGIE, BUCHAREST (ROMANIA).

Studies on the Determination of Anthropic Influences on the Hydrological Regime in Small Basins.
W91-06495 4C

INSTITUUT VOOR OECOLOGISCH ONDERZOEK, HETEREN (NETHERLANDS).

Device for Automatic Soil Moisture Control and Registration of Water Use in Pot Experiments.
W91-06313 3F

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION, BOISE, ID.

Increased Sedimentation Following Helicopter Logging and Prescribed Burning on Granitic Soil.
W91-06604 2J

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).

Chemical Emissions from the Processing and Use of Materials: The Need for an Integrated Emissions Accounting System.
W91-06109 5G

INTERNATIONAL INST. OF TROPICAL AGRICULTURE, IBADAN (NIGERIA).

Rice Hull and Caryopsis Discoloration Diseases: I. Severity and Incidence in Three Ecosystems in West Africa.
W91-06318 2I

Rice Hull and Caryopsis Discoloration Diseases: II. Effects of Soil and Soil Water on Hull Disease at Two Sites in Nigeria.
W91-06319 2I

INTERNATIONAL JOINT COMMISSION-UNITED STATES AND CANADA, WINDSOR (ONTARIO).

New Strategies for Great Lakes Toxicology.
W91-06926 5A

INTERNATIONAL RICE RESEARCH INST., LOS BANOS, LAGUNA (PHILIPPINES).

Soil Physical Behaviour and Crop Responses to Tillage in Lowland Rice Soils of Varying Clay Content.
W91-06315 3F

IOWA DEPT. OF NATURAL RESOURCES, IOWA CITY.

Nitrate in Ground Water in the United States.
W91-06734 5B

IOWA STATE UNIV., AMES. DEPT. OF AGRONOMY.

Sources of Nitrate to Ground Water.
W91-06733 5B

IOWA UNIV., OAKDALE. DEPT. OF PREVENTATIVE MEDICINE AND ENVIRONMENTAL HEALTH.

Chlorinated Drinking Water and Bladder Cancer: Effect of Misclassification on Risk Estimates.
W91-05982 5F

IRISH NATIONAL COMMITTEE FOR IHP, C/O OFFICE OF PUBLIC WORKS, DUBLIN.

Applications of Regional Flood Frequency Procedures in Ireland.
W91-06481 2E

IRKUTSKII GOSUDARSTVENNYI UNIV. (USSR). INST. OF PETROCHEMICAL AND COAL-CHEMICAL SYNTHESIS.

Alteration of Soil Organic Matter by Inundation.
W91-05978 2G

IRRIGATION AND POWER RESEARCH INST., AMRITSAR (INDIA).

Vortex-Settling Basin Design Considerations.
W91-06292 8B

ISFAHAN UNIV. (IRAN). DEPT. OF BIOLOGY.

Isolation of Some New Sulphur Bacteria from Activated Sludge.
W91-06004 5D

ISOTOPE LABORATORY, AS, NORWAY.

Effects of Naturally Occurring High and Low Molecular Weight Inorganic and Organic Species on the Yolk-Sack Larvae of Atlantic Salmon (Salmo salar L.) Exposed to Acidic Aluminum-Rich Lake Water.
W91-06749 5C

ISTITUTO DI BIOLOGIA DEL MARE, VENICE (ITALY).
Hydrocarbon Content and Microsomal BPH and Reductase Activity in Mussel, Mytilus sp., from the Venice Area, North-East Italy.
W91-06339 5C

IWATE UNIV., MORIOKA (JAPAN). FACULTY OF AGRICULTURE.
Composition and Behavior of Aluminum Ions and Colloidal Aluminosilicates in Acidified Terrestrial Waters.
W91-06979 2K

IZAAK WALTON LEAGUE OF AMERICA, DECORAH, IA.
Wildlife and Fish and Sustainable Agriculture.
W91-06306 5G

JACOBS ENGINEERING GROUP, INC., PASADENA, CA. HTM DIV.
Minimization of Process Equipment Cleaning Waste.
W91-06681 5G

JAMES COOK UNIV. OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA). DEPT. OF GEOGRAPHY.
Infiltration and Redistribution of Overland Flow and Sediment on a Low Relief Landscape of Semi-arid, Tropical Queensland.
W91-06529 2E

JAPAN SEWAGE WORKS ASSOCIATION, TOKYO.
Recent Developments in Wastewater Management in Japan.
W91-06041 5G

JAWAHARLAL NEHRU UNIV., NEW DELHI (INDIA). SCHOOL OF ENVIRONMENTAL SCIENCES.
Erosion, Transport and Deposition of Sediments by the Tropical Rivers of India.
W91-07115 2J

JIAOTONG UNIV., SHANGHAI (CHINA). DEPT. OF APPLIED CHEMISTRY.
Effect of Water Purification Ecological Engineering on the Cao Yang Round Creek.
W91-06052 5G

JILIN ARCHITECTURAL AND CIVIL ENGINEERING INST., CHANGCHUN (CHINA). DEPT. OF URBAN ENGINEERING.
Study of the Planning of Water Pollution Control for Second Songhua River in China.
W91-06043 5G

JOENSUU UNIV. (FINLAND). DEPT. OF BIOLOGY.
Uptake and Body Distribution of Chlorinated Phenolics in the Freshwater Mussel, Anodonta anatina L.
W91-06003 5B

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF PATHOLOGY.
Diethylnitrosamine (DEN)-Induced Degenerative, Proliferative and Neoplastic Lesions in the Liver of the Medaka (Oryzias latipes) Following Short-Term Exposure.
W91-06372 5C

JYVAESKYLAE UNIV. (FINLAND). DEPT. OF BIOLOGY.
Effects of Soil Fauna on Leaching of Nitrogen and Phosphorus from Experimental Systems Simulating Coniferous Forest Floor.
W91-06786 2K

KANGWEON NATIONAL UNIV., CHUNCHEON (REPUBLIC OF KOREA). DEPT. OF BIOLOGY.
Succession of Phytoplankton in Lake Soyang.
W91-06035 2H

KANSAS STATE UNIV., MANHATTAN. DEPT. OF HORTICULTURE.
Vertically Installed, Flush-mounted Tensiometer for Turfgrass Research.
W91-06413 7B

KANSAS STATE UNIV., MANHATTAN. DIV. OF BIOLOGY.
Site-Specific Underestimation of Wetfall NH4(+) Using NADP Data.
W91-06881 2K

Nitrogen Dynamics of Soil Water in Burned and Unburned Tallgrass Prairie.
W91-06966 2G

KARLSRUHE UNIV. (GERMANY, F.R.). ENGLER-BUNTE INST.
Ageing Effects of Highmolecular Weight Organic Acids Which Can Be Isolated from Landfill Leachates.
W91-06085 5B

Stationary Packer System for Layerwise Groundwater Sampling in Monitoring Wells--Technique and Results.
W91-06098 7B

KAROLINSKA INST., STOCKHOLM (SWEDEN). DEPT. OF PHYSIOLOGICAL CHEMISTRY.
Expression of Orthologues to Rat P-450IA1 and IIB1 in Sea-Birds from the Irish Sea 1987-88: Evidence for Environmental Induction.
W91-06342 5C

Differential Expression of Multiple Forms of Cytochrome P-450 in Vertebrates: Antibodies to Purified Rat Cytochrome P-450s as Molecular Probes for the Evolution of P-450 Gene Families I and II.
W91-06343 5C

KATHOLIEKE UNIV. LEUVEN (BELGIUM). LAB. VOOR EXPERIMENTELE GEOMORFOLOGIE.
Empirical Relationships for the Transport Capacity of Overland Flow.
W91-06720 2J

Conditions for the Evacuation of Rock Fragments from Cultivated Upland Areas During Rainstorms.
W91-06727 2J

KENT STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
Response of Anabaena flos-aquae (Cyanophyta) Nitrogenase Activity to Sudden Phosphate Deprivation.
W91-06257 2H

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON. DEPT. OF AGRONOMY.
Impact of Soil Management Practices on Nitrogen Leaching.
W91-06740 3F

KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). INST. FUER ANGEWANDTE PHYSIKALISCHE CHEMIE.
Atmospheric Deposition of Acid, Heavy Metals, Dissolved Organic Carbon , and Nutrients in the Dutch Delta Area in 1980-1986.
W91-06818 5B

KEURINGSINSTITUUT VOOR WATERLEIDINGARTIKELEN, RIJSWIJK (NETHERLANDS).
Assimilable Organic Carbon (AOC) in Drinking Water.
W91-06197 5F

KHON KAEN UNIV. (THAILAND). FACULTY OF AGRICULTURE.
Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: II. Seasonal Changes of Physical and Chemical Properties.
W91-06975 2K

Studies on Saline Soils in Khon Kaen Region, Northeast Thailand: III. Effects of Amelioration Treatments on Physical and Chemical Properties of the Saline Soil.
W91-06977 2K

KIEL UNIV. (GERMANY, F.R.). INST. FUER MEERESKUNDE.
Relationship Between Precipitation Amount and Wet Deposition of Nitrate and Ammonium.
W91-06879 5B

KING SAUD UNIV., RIYADH (SAUDI ARABIA). DEPT. OF CIVIL ENGINEERING.
Transport of Suspended Sediment in Ephemeral Channels.
W91-07068 2J

Methods of Estimating Bed Load Transport Rates Applied to Ephemeral Streams.
W91-07069 2J

KING SAUD UNIV., RIYADH (SAUDI ARABIA). DEPT. OF SOIL SCIENCE.
Combined Effects of Leaching Fraction, Salinity, and Potassium Content of Waters on Growth and Water-Use Efficiency of Wheat and Barley.
W91-06311 3F

KINKI UNIV., HIGASHIOSAKA (JAPAN). DEPT. OF AGRICULTURAL CHEMISTRY.
Quantitative Structure-Activity Studies of Pyrethroids: 21. Substituted Benzyl Esters of 'Kadethric' Acid and Depolarization of the Axonal Membrane of Crayfish.
W91-07005 5C

KINNERET LIMNOLOGICAL LAB., TIBERIAS (ISRAEL).
Bloom of a Brown Phototrophic Sulfur Bacterium in Lake Kinneret: Hydrochemical Aspects.
W91-06025 2H

KUMAUN UNIV., NAINI TAL (INDIA). DEPT. OF ZOOLOGY.
Sublethal Effects of an Organophosphorus Insecticide on Certain Metabolite Levels in a Freshwater Fish, Puntius conchonius Hamilton.
W91-07004 5C

KUOPIO UNIV. (FINLAND). DEPT. OF PHYSIOLOGY.
Bleached Kraft Pulpmill Effluents and TCDD: Effects on Biotransformation and Testosterone Status of Mature Male Rainbow Trout (Salmo gairdneri).
W91-06337 5C

KUWAIT INST. FOR SCIENTIFIC RESEARCH, SAFAT. ENVIRONMENTAL AND EARTH SCIENCES DIV.
Sewage-Related Impact on Kuwait's Marine Environment--A Case Study.
W91-06058 5C

Environmental Transformation, Photolysis of Fluorescing Petroleum Compounds in Marine Waters.
W91-06094 5A

KYOTO UNIV. (JAPAN).
Critical Rainfall (Danger Index) for Disasters Caused by Debris Flows and Slope Failures.
W91-06593 2J

KYOTO UNIV. (JAPAN). DEPT. OF AGRICULTURAL CHEMISTRY.

KYOTO UNIV. (JAPAN). DEPT. OF AGRICULTURAL CHEMISTRY.
Determination of Soluble Selenium in Soils.
W91-06970 5A

KYOTO UNIV. (JAPAN). DEPT. OF ENVIRONMENTAL AND SANITARY ENGINEERING.
Evaluation of Genotoxicity Using DNA Repairing Test for Chemicals Produced in Chlorination and Ozonation Processes.
W91-06075 5B

KYOTO UNIV. (JAPAN). DEPT. OF FORESTRY.
Estimating Discharge and Sediment Yield from a Forest Road.
W91-06607 2J

KYOTO UNIV. (JAPAN). DISASTER PREVENTION RESEARCH INST.
Possible Hydrological and Geomorphological Changes Due to Alteration of Forest.
W91-06526 4C

Estimation of Debris Flow Hydrograph on Varied Slope Bed.
W91-06590 2J

Large-Scale Debris Avalanche as an Episode in Slope-Channel Processes.
W91-06595 2J

KYOTO UNIV. (JAPAN). FACULTY OF AGRICULTURE.
Erosion Research and Control in Japan.
W91-06572 4D

Sediment Yield from Bare Slopes Due to Landslides in Central Japan.
W91-06600 2J

KYOTO UNIV., OTSU (JAPAN). OTSU HYDROBIOLOGICAL STATION.
Evolving Issues on Development and Conservation of Lake Biwa--Yodo River Basin.
W91-06049 6D

KYUSHU UNIV., FUKUOKA (JAPAN). DEPT. OF CIVIL ENGINEERING.
Weighted Finite Difference and Boundary Element Methods Applied to Groundwater Pollution Problems.
W91-06095 5B

KYUSHU UNIV., FUKUOKA (JAPAN). DEPT. OF FISHERIES.
Mechanism of Abrupt Increase in Toxicity of Organophosphorothionates to Tiger Shrimp Larvae with Progress of Stages.
W91-06092 5C

KYUSHU UNIV., FUKUOKA (JAPAN). RADIOISOTOPE CENTER.
Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: I. Stabilities of Metal Species Adsorbed on Particulates.
W91-06819 2K

Adsorption of Fe(III), Co(II), and Zn(II) onto Particulates in Fresh Waters on the Basis of the Surface Complexation Model: II. Stabilities of Metal Species Dissolved in Fresh Waters.
W91-06820 2K

LABORATOIRE DES XENOBIOTIQUES, TOULOUSE (FRANCE).
Hydroxylation of Pristane by Isolated Hepatocytes of Rainbow Trout: A Comparison with In Vivo Metabolism and Biotransformation by Liver Microsomes.
W91-06325 5B

LAGOS UNIV. (NIGERIA). DEPT. OF GEOGRAPHY.
Consequences of the Recent Climatic Variations on River Flow Regimes in West Africa.
W91-06487 2A

LAKEHEAD UNIV., THUNDER BAY (ONTARIO). AQUATIC TOXICITY RESEARCH GROUP.
Acute and Chronic Toxicity of Ten Chlorinated Organic Compounds to the American Flagfish (Jordanella floridae).
W91-06779 5C

LANCASTER UNIV. (ENGLAND). INST. OF ENVIRONMENTAL AND BIOLOGICAL SCIENCES.
Method for the Sampling and Removal of Ionic Alkyllead Compounds from Aqueous Solution Using Ion Exchange Media.
W91-06869 5G

LAND CAPABILITY CONSULTANTS LTD., CAMBRIDGE (ENGLAND).
Deforestation and Erosion in the Nepalese Himalaya--Is the Link Myth or Reality.
W91-06533 4C

Sediment Production and Transport in the Phewa Valley, Nepal.
W91-06645 2J

LANDWIRTSCHAFTLICHE UNTERSUCHUNGS- UND FORSCHUNGSANSTALT, SPEYER (GERMANY, F.R.).
Pollutants in Soil, Particularly Heavy Metals and Harmful Organic Substances, after Yearly Usage of Municipal Wastes (Schadstoffe im Boden insbesondere Schwermetalle und organische Schadstoffe aus langjahriger Anwendung von Siedlungsabfallen).
W91-07040 5B

LATHAM AND WATKINS, LOS ANGELES, CA.
Waste Minimization Liability Issues.
W91-06680 5G

LAWRENCE LIVERMORE NATIONAL LAB., CA.
Toward More Realistic Material Models for Release and Dispersion of Heavy Gases.
W91-07048 5B

LAWRENCE LIVERMORE NATIONAL LAB., CA. ENVIRONMENTAL SCIENCES DIV.
Sublethal Responses of Platichthys stellatus to Organic Contamination in San Francisco Bay with Emphasis on Reproduction.
W91-06180 5C

LEEDS UNIV. (ENGLAND). SCHOOL OF GEOGRAPHY.
Simulation Model for Desert Runoff and Erosion.
W91-06723 2E

LEHIGH UNIV., BETHLEHEM, PA. DEPT. OF CIVIL ENGINEERING.
Predicting Incipient Fluidization of Fine Sands in Unbounded Domains.
W91-07028 8B

LINCOLN COLL., CANTERBURY (NEW ZEALAND). DEPT. OF PLANT SCIENCE.
Effect of Water Stress, Nitrogen, and Gibberellic Acid on Fluazifop and Glyphosate Activity on Oats (Avena sativa).
W91-06981 3F

LIVERPOOL SCHOOL OF TROPICAL MEDICINE (ENGLAND). DEPT. OF INTERNATIONAL COMMUNITY HEALTH.
Determinants of Domestic Water Use in Rural Nicaragua.
W91-06119 6D

LOCKHEED ENGINEERING AND SCIENCES CO., INC., LAS VEGAS, NV.
Ground Water Contamination at Wood Treatment Facilities.
W91-06854 5B

LOS ALAMOS NATIONAL LAB., NM. NUCLEAR MATERAISL DIV.
Extraction of Plutonium from Lean Residues by Room-Temperature Fluoride Volatility.
W91-06676 5D

LOUGHBOROUGH UNIV. OF TECHNOLOGY (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Riverflow Prediction During Baseflow Recession on Some British Hard Rock Catchments.
W91-06468 2E

LOUISIANA STATE UNIV., BATON ROUGE. CENTER FOR WETLAND RESOURCES.
Marsh-Water Column Interactions in Two Louisiana Estuaries. II. Nutrient Dynamics.
W91-06837 2L

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.
Internal Hydraulics of a Sediment-Stratified Channel Flow.
W91-06817 2L

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF AGRICULTURAL ENGINEERING.
USLE P Factors for Subsurface Drainage on Low Slopes in a Hot, Humid Climate.
W91-06117 4D

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF AGRONOMY.
Soil Water Assessment Model for Several Crops in the High Plains.
W91-06399 2G

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF BIOCHEMISTRY.
Purification and Properties of Hepato-pancreas and Green Gland Cytosolic Glutathione S-Transferases of the Red Swamp Crayfish, Procambarus clarkii.
W91-06335 5C

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF MARINE SCIENCE.
Marsh-Water Column Interactions in Two Louisiana Estuaries. I. Sediment Dynamics.
W91-06836 2J

LOUISIANA STATE UNIV., BATON ROUGE. INST. FOR ENVIRONMENTAL STUDIES.
Induction of the Hepatic Microsomal Mixed-Function Oxygenase (MFO) System of Alligator mississippiensis by 3-Methylcholanthrene (3-MC).
W91-06334 5C

Assessment of the Genotoxicity of Produced Water Discharges Associated with Oil and Gas Production Using a Fish Embryo and Larval Test.
W91-06365 5C

Coastal Oil Drilling Produced Waters: Chemical Characterization and Assessment of Genotoxicity Using Chromosomal Aberrations in Cyprinodon variegatus.
W91-06716 4C

LOUISIANA TECH UNIV., RUSTON. DEPT. OF GEOSCIENCES.
Erosion and Sediment Transport by Windthrow in a Mountain Beech Forest, New Zealand.
W91-06609 2J

LOUISVILLE UNIV., KY. DEPT. OF BIOLOGY.
Histopathology of Atlantic Tomcod: A Possible Monitor of Xenobiotics in Northeast Tidal Rivers and Estuaries.
W91-06178 5A

LOWENBERG ASSOCIATES, INC., ROCKVILLE, MD.
Development of a Composite Polyethylene--Fiberglass-Reinforced-Plastic High-Integrity Container for Disposal of Low-Level Radioactive Waste.
W91-06131 5E

MAINE UNIV. AT ORONO. DEPT. OF PLANT AND SOIL SCIENCES.
Rhizosphere pH and Aluminum Chemistry of Red Oak and Honeylocust Seedlings.
W91-06964 5C

MAINZ UNIV. (GERMANY, F.R.). DEPT. OF ZOOLOGY.
Toxicity of Lindane, Atrazine, and Deltamethrin to Early Life Stages of Zebrafish (Brachydanio rerio).
W91-05996 5C

MANIPUR UNIV., IMPHAL (INDIA). DEPT. OF LIFE SCIENCES.
Interactions of Xenobiotics with Reproductive Endocrine Functions in a Protogynous Teleost, Monopterus albus.
W91-06364 5C

MARINE BIOLOGICAL LAB., WOODS HOLE, MA. ECOSYSTEMS CENTER.
Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater.
W91-06957 5B

MARTIN MARIETTA ENERGY SYSTEMS, INC., OAK RIDGE, TN.
Leaching and Comprehensive Regulatory Performance Testing of an Extruded Bitumen Containing a Surrogate, Sodium Nitrate-Based, Low-Level Waste.
W91-06128 5E

MARYLAND UNIV. AT BALTIMORE. DEPT. OF BIOLOGICAL SCIENCES.
Detection of Major Stress Protein Using a Peptide Antibody.
W91-06387 5C

MARYLAND UNIV. BALTIMORE COUNTY, CATONSVILLE. DEPT. OF BIOLOGICAL SCIENCES.
Stress Proteins: Their Detection and Uses in Biomonitoring.
W91-06714 5C

MARYLAND UNIV., COLLEGE PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Reduction of Nitrate Loadings to Ground Water.
W91-06851 5G

MARYLAND UNIV. EASTERN SHORE, PRINCESS ANNE.
Changes in Poultry Litter Toxicity with Simulated Acid Rain.
W91-05991 5C

MARYLAND UNIV., SOLOMONS. CENTER FOR ENVIRONMENTAL AND ESTUARINE STUDIES.
Forecasting the Abundance of the Sea Nettle, Chrysaora quinquecirrha, in the Chesapeake Bay.
W91-06845 2L

MARYLAND UNIV., SOLOMONS. CHESAPEAKE BIOLOGICAL LAB.
Interannual Patterns of Water Table Height and Groundwater Derived Nitrate in Nearshore Sediments.
W91-06955 2F

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CHEMISTRY.
c-K-ras Oncogenes: Prevalence in Livers of Winter Flounder from Boston Harbor.
W91-06185 5C

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF MECHANICAL ENGINEERING.
In-Situ Extraction of Contaminants from Hazardous Waste Sites by Electroosmosis.
W91-06444 5G

MASSACHUSETTS UNIV., AMHERST. SCHOOL OF PUBLIC HEALTH.
Peroxisome Proliferation as an Epigenetic Mechanism of Carcinogenesis: Relevance to Aquatic Toxicology.
W91-06712 5C

MASSACHUSETTS UNIV. AT BOSTON. ENVIRONMENTAL SCIENCE PROGRAM.
Trophic Transfer of Benzo(a)pyrene Metabolites Between Benthic Marine Organisms.
W91-06361 5B

MASSEY UNIV., PALMERSTON NORTH (NEW ZEALAND). DEPT. OF BIOTECHNOLOGY.
Biological Treatment of a Landfill Leachate Containing Phenoxy Herbicides and Chlorophenols.
W91-06084 5D

MAX-PLANCK-INST. FUER LIMNOLOGIE, SCHLITZ (GERMANY, F.R.). LIMNOLOGISCHE FLUSSSTATION.
Comparison of the Dietary Composition of Epilithic Trichopteran Species in a First-Order Stream.
W91-06752 2H

MAX-PLANCK-INST. FUER LIMNOLOGIE ZU PLOEN (GERMANY, F.R.).
Daphnia Growth at Different Concentrations of Blue-Green Filaments.
W91-06754 2H

MAX-PLANCK-INST. FUER LIMNOLOGIE ZU PLOEN (GERMANY, F.R.). ABT. OEKOPHYSIOLOGIE.
Coexistence of Daphnia Species and Their Hybrids: An Experimental Population Genetics Approach.
W91-06761 2H

MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF GEOGRAPHY.
Dissolved Organic Carbon in Forested and Cut-over Drainage Basins, Westland, New Zealand.
W91-06555 4A

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF GEOGRAPHY.
Effects of Forests on Wetland Runoff during Spring.
W91-06538 2E

MEIJI UNIV., KAWASAKI (JAPAN). FACULTY OF AGRICULTURE.
Distribution and Algal-Lysing Activity of Fruiting Myxobacteria In Lake Suwa.
W91-06251 2H

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT. OF BIOLOGY.
Long Term Effects of Crude Oil on Common Murres (Uria aalge) Following Rehabilitation.
W91-06889 5C

METCALF AND EDDY, INC., WAKEFIELD, MA.
Surface Charge on Wastewater Sludges.
W91-06439 5D

MEXICAN INST. OF WATER TECHNOLOGY, PROGRESO.
Optimal Spectral Base-Flow Estimation.
W91-07034 2E

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF CROP AND SOIL SCIENCES.
Denitrification in North Temperate Forest Soils: Relationships between Denitrification and Environmental Factors at the Landscape Scale.
W91-06963 2G

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF FISHERIES AND WILDLIFE.
Maternal Transfer of Bioactive Polychlorinated Aromatic Hydrocarbons in Spawning Chinook Salmon (Oncorhynchus tshawytscha).
W91-06356 5B

Flow Cytometric Techniques to Assess Toxicity to Algae.
W91-06707 5C

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF PEDIATRICS/HUMAN DEVELOPMENT.
Planar Chlorinated Hydrocarbons (PCHs) in Colonial Fish-Eating Waterbird Eggs from the Great Lakes.
W91-06393 5C

MICHIGAN STATE UNIV., EAST LANSING. PESTICIDE RESEARCH CENTER.
Assessing Atrazine Persistence in Soil Following a Severe Drought.
W91-05985 5A

Effects of Deltamethrin on Protein Phosphorylation and Dephosphorylation Process in the Nerve Fibers of the American Lobster, Homerus americanus L.
W91-07003 5C

MICHIGAN UNIV., ANN ARBOR. CENTER FOR GREAT LAKES AND AQUATIC SCIENCES.
Biomagnification of Polychlorinated Biphenyls, Toxaphene, and DDT Compounds in a Lake Michigan Offshore Food Web.
W91-06778 5B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF BIOLOGY.
Role of Aluminum and Growth Rate on Changes in Cell Size and Silica Content of Silica-Limited Populations of Asterionella ralfsii var. americana (Bacillariophyceae).
W91-06249 5C

MICHIGAN UNIV., ANN ARBOR. SCHOOL OF PUBLIC HEALTH.
Carbon-14 Tracer Study of Polyacrylate Polymer in a Wastewater Plant.
W91-06245 5D

MIDDLE EAST TECHNICAL UNIV., ANKARA (TURKEY). DEPT. OF ENVIRONMENTAL ENGINEERING.
Effect of Chromium (VI) on Activated Sludge.
W91-06866 5D

MIDDLE TENNESSEE STATE COLL., MURFREESBORO.
Bacteriological Water Quality of Recreational Areas: J. Percy Priest Park, Tennessee.
W91-06020 5B

MIDDLEBURY COLL., VT. DEPT. OF BIOLOGY.
Differential Colonization and Growth of Algae and Ferromanganese-Depositing Bacteria in a Mountain Stream.
W91-06018 2H

MIDDLESEX POLYTECHNIC, ENFIELD (ENGLAND).
River Basin Management in the UK.
W91-06045 6E

MILAN UNIV. (ITALY). IST. DI FARMACOLOGIA E FARMACOGNOSIA.

MILAN UNIV. (ITALY). IST. DI FARMACOLOGIA E FARMACOGNOSIA.
Focus on Toxicological Aspects of Pesticide Chemical Interaction in Drinking Water Contamination.
W91-05995 5F

MILLER DRILLING CO., LAWRENCEBURG, TN.
Project Management.
W91-06848 6A

MILLIPORE CORP., BEDFORD, MA.
Invertebrates and Associated Bacteria in Drinking Water Distribution Lines.
W91-06205 5F

Thin Cake Filtration: Theory and Practice.
W91-06425 5D

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, WEYMOUTH (ENGLAND). FISH DISEASES LAB.
Measurement of Disease Susceptibility in Dab, Limanda limanda L., Following Long-term Exposure to Contaminated Sediments: Preliminary Studies.
W91-06371 5C

MINISTRY OF CONSTRUCTION, TOKYO (JAPAN). DEPT. OF SEWERAGE AND SEWAGE PURIFICATION.
River Basin Water Quality Management in Japan - An Overview.
W91-06042 5G

MINISTRY OF HEALTH AND WELFARE, TOKYO (JAPAN). WATER SUPPLY AND ENVIRONMENTAL SANITATION DEPT.
Current Situation and Problems of Japanese International Cooperation in the Field of Water Supply and Waste Management.
W91-06062 6E

MINISTRY OF HEALTH, KUALA LUMPUR (MALAYSIA). ENGINEERING SERVICES DIV.
Development of Drinking Water Quality Surveillance in Malaysia.
W91-06065 5F

MINISTRY OF HEALTH, MANAMA (BAHRAIN). PUBLIC HEALTH DIRECTORATE.
Chemical Quality of Drinking Water in Bahrain.
W91-06237 5F

MINISTRY OF WATER DEVELOPMENT, MOMBASA (KENYA).
Strategy for Organizing a Sediment Data Collection Network Based on the Available Hydrological Records for a Catchment in Kenya.
W91-07077 2J

MINISTRY OF WORKS AND DEVELOPMENT, LOWER HUTT (NEW ZEALAND). CENTRAL LABS.
Modelling Bed-Load Transport in Steep Mountain Streams.
W91-06619 2J

MINNESOTA UNIV.-DULUTH. NATURAL RESOURCES RESEARCH INST.
Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach.
W91-06947 2H

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINERAL ENGINEERING.
Removing VOCs by Membrane Stripping.
W91-06814 5F

MINNESOTA UNIV., MINNEAPOLIS. ST. ANTHONY FALLS HYDRAULIC LAB.
Selective Sorting and Abrasion of River Gravel: I. Theory.
W91-06290 2J

Selective Sorting and Abrasion of River Gravel: II. Applications.
W91-06291 2E

Surging in Urban Storm Drainage Systems.
W91-07033 5D

MINNESOTA UNIV., NAVARRE. GRAY FRESHWATER BIOLOGICAL INST.
Effect of Long-Term Water Velocity Changes on Streambed Biofilm Activity.
W91-06859 5B

MINNESOTA UNIV., ST. PAUL. DEPT. OF SOIL SCIENCE.
Cropping Systems: Ecology and Management.
W91-06741 3F

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. FOREST PRODUCTS UTILIZATION LAB.
Evaluation of Wood-Treating Plant Sites for Land Treatment of Creosote and Pentachlorophenol-Contaminated Soils.
W91-06670 5G

MISSISSIPPI UNIV., UNIVERSITY. DEPT. OF PHARMACOLOGY.
Metallothionein as a Biomarker of Environmental Metal Contamination: Species-Dependent Effects.
W91-06187 5A

MISSOURI UNIV.-COLUMBIA. ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER.
Sentinel Species and Sentinel Bioassay.
W91-06190 5A

MOHAMED-1 UNIV., OUJDA (MOROCCO). DEPT. DE BIOLOGIE.
Influence of Season on the Breakdown of Submerged Leaves.
W91-06751 2H

MONSANTO AGRICULTURAL CO., ST. LOUIS, MO.
Field Calibration of SURFACE: A Model of Agricultural Chemicals in Surface Waters.
W91-06007 5A

MONSANTO CO., ST. LOUIS, MO.
Use of Microcosms versus Conventional Biodegradation Testing for Estimating Chemical Persistence.
W91-06695 5C

MONTANA STATE UNIV., BOZEMAN. DEPT. OF EARTH SCIENCES.
Application of Auger Electron Spectroscopy to Studies of Chemical Weathering.
W91-07035 2K

MONTANA STATE UNIV., BOZEMAN. DEPT. OF MICROBIOLOGY.
Yersinia enterocolitica in Drinking Water.
W91-06209 5F

Injury of Enteropathogenic Bacteria in Drinking Water.
W91-06211 5F

Enumeration, Occurrence, and Significance of Injured Indicator Bacteria in Drinking Water.
W91-06217 5A

MONTANA STATE UNIV., BOZEMAN. DEPT. OF PLANT AND SOIL SCIENCE.
MAPS: A GIS for Land Resource Management in Montana.
W91-06115 7C

MONTANA STATE UNIV., BOZEMAN. INST. FOR BIOLOGICAL AND CHEMICAL PROCESS ANALYSIS.
Biofilms in Potable Water Distribution Systems.
W91-06206 5F

MONTEREY PENINSULA WATER POLLUTION CONTROL AGENCY, CA.
Changes in Sediment Storage Over Time on a Coastal California River.
W91-06639 2J

MONTGOMERY (JAMES M.) CONSULTING ENGINEERS, INC., PASADENA, CA.
Centrifuge Thickening: Full-Scale Testing and Design Considerations.
W91-06428 5D

Assessing Hollow-Fiber Ultrafiltration for Particulate Removal.
W91-06813 5F

MONTPELLIER-2 UNIV. (FRANCE). LAB. D'HYDROBIOLOGIE MARINE.
Natural Recolonization of a Chronically Oil-Polluted Mangrove Soil after a De-Pollution Process.
W91-06266 5G

MOSCOW STATE UNIV. (USSR). DEPT. OF SOIL SCIENCE.
Effect of Wetting and Drying on the Soil Structure.
W91-05979 2G

MOTT MACDONALD GROUP, CROYDON (ENGLAND).
Strategies of Trace Metal Sequestration in Aquatic Organisms.
W91-06352 5B

MOUNT DESERT ISLAND BIOLOGICAL LAB., SALSBURY COVE, ME.
Inhibition of Corneal Epithelial Cell Migration by Cadmium and Mercury.
W91-06891 5C

MURDOCH UNIV. (WESTERN AUSTRALIA). SCHOOL OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES.
Study of the Eutrophication of North Lake, Western Australia.
W91-06056 5C

Bacteria and Virus Removal from Secondary Effluent in Sand and Red Mud Columns.
W91-06068 5D

NAGOYA UNIV. (JAPAN). DEPT. OF APPLIED CHEMISTRY.
Determination of Total Mercury Concentration in Wastewater by Continuous Microflow Analysis with Cold Vapor Atomic Absorption Spectrometry.
W91-06822 5A

NAGOYA UNIV. (JAPAN). LAB. OF SOIL SCIENCE.
Enrichment Process of 2,4-D Degraders in Different Soils under Upland Conditions.
W91-06973 5B

NAGOYA UNIV. (JAPAN). WATER RESEARCH INST.
Carbon Isotope Discrimination by Phytoplankton and Photosynthetic Bacteria in Monomictic Lake Fukami-ike.
W91-06763 2H

NAIROBI UNIV. (KENYA). DEPT. OF PUBLIC HEALTH, PHARMACOLOGY AND TOXICOLOGY.
Organochlorine Residues in Fish from Lake Victoria, Kenya.
W91-06746 5B

NATAL UNIV., PIETERMARITZBURG (SOUTH AFRICA). DEPT. OF AGRICULTURAL ENGINEERING.
Simulation of Effects of Forest Growth on Water Yield with a Dynamic Process-based user Model.
W91-06565 4C

NATIONAL AGRARIAN UNIV., LIMA (PERU). DEPT. MANEJO FORESTAL.
Test of an Erodibility Rating System for the Foothills of Central Alberta, Canada.
W91-06524 2J

Erosion and Sedimentation Issues in Peru.
W91-06571 2J

NATIONAL BUREAU OF OCEANOGRAPHY, HANGZHOU (CHINA). SECOND INST. OF OCEANOGRAPHY.
Fine-Grained Sediment Transport and Sorting by Tidal Exchange in Xiangshan Bay, Zhejiang, China.
W91-06767 2L

NATIONAL BUREAU OF OCEANOGRAPHY, XIAMEN (CHINA). THIRD INST. OF OCEANOGRAPHY.
Effects of a Mixture of Cu, Cd, Hg and Zn on Marine Plankton: Marine Ecosystem Enclosure Experiment.
W91-06102 5C

Effects of Sediment from an Industrial Outfall Area on a Marine Planktonic Ecosystem.
W91-06103 5C

Pathway and Fate of the Heavy Metal Mixture in Xiamen Marine Experiment Enclosures.
W91-06104 5B

Ecological Studies on the Hydromedusae, Siphonophores and Ctenophores in the Xiamen Harbor and Adjacent Waters.
W91-06106 2L

NATIONAL CHENG KUNG UNIV., TAINAN (TAIWAN). DEPT. OF ENVIRONMENTAL ENGINEERING.
Waste Allocation Models for Risk Assessment of Water Quality Management in a River Basin.
W91-06047 5G

NATIONAL CHUNGHSING UNIV., TAICHUNG (TAIWAN).
Assessment of Transferability of USLE to Taiwan.
W91-06601 2J

NATIONAL CONFERENCE OF STATE LEGISLATURES, DENVER, CO.
Growth Management: A Renewed Agenda for States.
W91-06227 6B

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INST., NAGPUR (INDIA). WATER ENGINEERING DIV.
Optimizing Physical Parameters of Rapid Mix Design for Coagulation-Flocculation of Turbid Waters.
W91-06863 5F

NATIONAL FISH HEALTH RESEARCH LAB., KEARNEYSVILLE, WV.
Reduction in the Numbers of Antibody-Producing Cells in Rainbow Trout, Oncorhynchus mykiss, Exposed to Sublethal Doses of Phenol Before Bath Immunization.
W91-06713 5C

NATIONAL FISHERIES CONTAMINANT RESEARCH CENTER, COLUMBIA, MO.
Testing Sediment Toxicity with Hyalella azteca (Amphipoda) and Chironomus riparius (Diptera).
W91-06698 5A

Distribution and Bioaccumulation of Selenium in Aquatic Microcosms.
W91-06803 5B

NATIONAL FISHERIES CONTAMINANT RESEARCH CENTER, YANKTON, SD. FIELD RESEARCH STATION.
Safety Assessment of Selected Inorganic Elements to Fry of Chinook Salmon (Oncorhynchus tahawytscha).
W91-06000 5C

Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids.
W91-06001 5C

NATIONAL FISHERIES RESEARCH CENTER-GREAT LAKES, ANN ARBOR, MI.
Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish.
W91-06882 5C

NATIONAL FISHERIES RESEARCH CENTER, LA CROSSE, WI.
Macroinvertebrate Communities Associated with Three Aquatic Macrophytes (Certophyllum demersum, Myriophyllum spicatum, and Vallisneria americana) in Lake Onalaska, Wisconsin.
W91-06016 2H

NATIONAL GEOPHYSICAL RESEARCH INST., HYDERABAD (INDIA).
Management of Ground-Water Resources Using Simulation Models.
W91-06900 2F

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, EAST LIBERTY, OH. VEHICLE RESEARCH AND TEST CENTER.
Depositional Record of a Glacial-lake Outburst: Glacial Lake Souris, North Dakota.
W91-06411 2J

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN).
Factors Explaining Sediment Concentrations of 16 Elements in 28 Japanese Eutrophic Lakes.
W91-06090 5B

Fate of Linear Alkylbenzenesulfonates in a Lake Estuary.
W91-06093 5B

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN). WATER AND SOIL ENVIRONMENT DIV.
Change in C:N:P Ratios During Passage of Water Areas from Rivers to a Lake.
W91-06870 5B

NATIONAL INST. OF AGRO-ENVIRONMENTAL SCIENCES, KANNONDAI (JAPAN). DIV. OF SOIL SCIENCE.
Solute Dispersion during Unsteady Leaching as Affected by Aggregate Size and Soil Water Content.
W91-06968 2K

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC. BEAUFORT LAB.
Immigration of Larvae of Fall/Winter Spawning Marine Fishes into a North Carolina Estuary.
W91-06841 2L

NATIONAL OCEAN SERVICE, SEATTLE, WA. OCEAN ASSESSMENTS DIV.
Comparative Evaluation of Selected Measures of Biological Effects of Exposure of Marine Organisms to Toxic Chemicals.
W91-06192 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
Toxicity and Toxicokinetics of Pentachlorophenol and Carbaryl to Pontoporeia hoyi and Mysis relicta.
W91-06710 5C

Toxicokinetics and Toxicity of a Mixture of Sediment-Associated Polycyclic Aromatic Hydrocarbons to the Amphipod Diporeia sp.
W91-06993 5C

NATIONAL PINGTUNG INST. OF AGRICULTURE (TAIWAN).
Hydromechanical Erosion Model for Surface-Mined Areas.
W91-06599 4C

NATIONAL POWER, LEATHERHEAD (ENGLAND). TECHNOLOGY AND ENVIRONMENTAL CENTRE.
Accelerated Nitrogen Inputs--A New Problem or a New Perspective.
W91-06320 5B

NATIONAL RESEARCH CENTER FOR DISASTER PREVENTION, SAKURA (JAPAN).
Experimental Study of Slope Failure Caused by Heavy Rainfall.
W91-06583 2J

Experimental Study on the Phenomena of Rain Infiltration.
W91-06598 2B

Drainage Basin Characteristics Affecting Sediment Discharge from Steep Mountain Basins.
W91-06631 2J

NATIONAL RESEARCH CENTRE, CAIRO (EGYPT).
Purification of Highly Contaminated Waste Waters by Using Cement Dust: A Possible Approach.
W91-06897 5D

NATIONAL RESEARCH CENTRE, CAIRO (EGYPT). WATER POLLUTION CONTROL LAB.
Growth Response of Freshwater Algae, Anabaena flos-aquae and Selenastrum capricornutum to Atrazine and Hexazinone Herbicides.
W91-06890 5C

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO). DIV. OF BIOLOGICAL SCIENCES.
Case History: Minimata Mercury Pollution in Japan - From Loss of Human Lives to Decontamination.
W91-06070 5B

Fate of Plutonium Released from the Nagasaki A-Bomb, Japan.
W91-06071 5B

NATIONAL RESEARCH INST. FOR POLLUTION AND RESOURCES, YATABE (JAPAN).
Indirect Inductively Coupled Plasma Atomic Emission Determination of Fluoride in Water Samples by Flow Injection Solvent Extraction.
W91-07011 7B

NATIONAL RESPONSE TEAM, WASHINGTON, DC.
National Response Team: A Report on the National Oil and Hazardous Substances Response System.
W91-07036 5G

NATIONAL RIVERS AUTHORITY, THAMES REGION, ENGLAND.
River Catchment Planning for Land Drainage, Flood Defence and the Environment.
W91-05971 4A

NATIONAL SEVERE STORMS LAB., NORMAN, OK.
Dependence of Reflectivity Factor-Rainfall Rate Relationship on Polarization.
W91-06113 2B

NATIONAL SOIL TILTH LAB., AMES, IA.
Rainfall Distribution under a Corn Canopy: Implications for Managing Agrochemicals.
W91-06401 3F

NATIONAL SWEDISH ENVIRONMENT PROTECTION BOARD, SOLNA.
Toxicity Test with Algae: A Discussion on the Batch Method.
W91-06002 5A

NATIONAL TAIWAN UNIV., TAIPEI. DEPT. OF CIVIL ENGINEERING.
Study of Erosion of Lateritic Soil of Linkou Terrace.
W91-06602 2J

NATIONAL UNIV. OF SINGAPORE.
Near Surface Hydrological Processes Under Changing Land Use in Humid-Equatorial Conditions.
W91-06494 4C

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). GROUNDWATER CONTAMINATION SECTION.
Investigation of Possible Contamination of Shallow Ground Water by Deeply Injected Liquid Industrial Wastes.
W91-06856 5B

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). RIVERS RESEARCH BRANCH.
Effects of Dissolved Organic Carbon on Accumulation and Acute Toxicity of Fenvalerate, Deltamethrin and Cyhalothrin to Daphnia magna (Straus).
W91-06999 5C

NAVAL MEDICAL RESEARCH UNIT NO. 2, MANILA (PHILIPPINES).
Toxorhynchites amboinensis Larvae Released in Domestic Containers Fail to Control Dengue Vectors in a Rural Village in Central Java.
W91-06121 5F

NEBRASKA GAME AND PARKS COMMISSION, NORFOLK.
Chemical and Physical Characteristics of the Missouri River, Nebraska.
W91-07009 6G

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRICULTURAL ECONOMICS.
Cropping and Tillage Options to Achieve Erosion Control Goals and Maximum Profit on Irregular Slopes.
W91-06233 2J

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRONOMY.
Rotation and Continuous Use of Dietholate, Fonofos, and SC-0058 on EPTC Persistence in Soil.
W91-06984 5B

NEBRASKA UNIV.-LINCOLN. DEPT. OF ENTOMOLOGY.
Effects of Substrate on Density of Aquatic Insects in a Southeast Nebraska Stream.
W91-07008 2E

NEBRASKA UNIV.-LINCOLN. DEPT. OF FORESTRY, FISHERIES AND WILDLIFE.
Persistence of a Chemical Gradient in the Lower Platte River, Nebraska.
W91-07010 6G

NETHERLANDS ENERGY RESEARCH FOUNDATION ECN, PETTEN.
Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials.
W91-06136 5E

Leaching Characteristics of Selected Elements from Coal Fly Ash as a Function of the Acidity of the Contact Solution and Liquid/Solid Ratio.
W91-06138 5E

NEW BRUNSWICK RESEARCH AND PRODUCTIVITY COUNCIL, FREDERICTON. CHEMICAL AND BIOTECHNICAL SERVICES.
Field Efficacy of Vectobac-12AS and Vectobac-24AS Against Black Fly Larvae in New Brunswick Streams (Diptera: Simuliidae).
W91-06120 5G

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF CHEMISTRY.
Membrane for In Situ Optical Detection of Organic Nitro Compounds Based on Fluorescence Quenching.
W91-07014 5A

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF CIVIL ENGINEERING.
Evaluating the Freeze-Thaw Durability of Portland Cement-Stabilized-Solidified Heavy Metal Waste Using Acoustic Measurements.
W91-06139 5E

Column Leach Testing of Phenol and Trichloroethylene Stabilized/Solidified with Portland Cement.
W91-06144 5E

NEW JERSEY MEDICAL SCHOOL, NEWARK. DEPT. OF ANATOMY.
Treated Municipal Wastewaters: Effects on Development and Growth of Fishes.
W91-06396 5C

Toxicity to Estuarine Organisms of Leachates from Chromated Copper Arsenate Treated Wood.
W91-06782 5C

NEW MEXICO STATE ENGINEER OFFICE, SANTA FE.
Land Use, Erosion Rates, and Reservoir Sedimentation in a Coastal Ecuadorian Watershed.
W91-06650 2J

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRONOMY AND HORTICULTURE.
Sludge Organics Bioavailability.
W91-06449 5B

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CIVIL ENGINEERING.
Recovery of a New Mexico Drainage Basin from a Forest Fire.
W91-06528 2F

NEW SOUTH WALES DEPT. OF AGRICULTURE, RYDALMERE (AUSTRALIA). BIOLOGICAL AND CHEMICAL RESEARCH INST.
Movement of Bromacil and Hexazinone in a Municipal Site.
W91-06895 5B

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF GEOGRAPHY.
Channel Sediment Behaviour as a Basis for Modelling Delivery Processes.
W91-07113 2J

NEW ZEALAND SOIL BUREAU, LOWER HUTT.
Importance of Soil Water Content when Estimating Soil Microbial C, N and P by the Fumigation-Extraction Methods.
W91-06961 2G

NEWCASTLE UNIV. (AUSTRALIA). DEPT. OF CIVIL ENGINEERING.
Model of River Basin Evolution.
W91-07026 2J

NEWCASTLE UPON TYNE UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Critical Conditions for Bed Material Movement in Steep, Boulder-Bed Streams.
W91-06618 2J

Application of Two Physically-based Sediment Yield Models at Plot and Field Scales.
W91-07117 2J

NIAGARA MOHAWK POWER CORP., SYRACUSE, NY.
Earthworm and Soil Microarthropod Responses to Oily Waste Application.
W91-06962 5C

NICE UNIV. (FRANCE). DEPT. ABSORPTION BIOTRANSFORMATION ET CANCEROGENESE.
Uptake Metabolism and Biological Half-Life of Benzo(a)pyrene in Different Tissues of Sea Bass, Dicentrarchus labrax.
W91-05994 5B

NIGERIA UNIV., NSUKKA. DEPT. OF GEOLOGY.
Performance of Gully Erosion Control Measures in Southeastern Nigeria.
W91-06525 4D

NORGES VASSDRAGS- OG ELEKTRISITETSVESEN, OSLO.
Monitoring Programme of Sediment Transport in Norwegian Rivers.
W91-07074 2J

NORGES VASSDRAGS- OG ELEKTRISITETSVESEN, OSLO. HYDROLOGICAL DIV.
Flood-Calculations in Norway.
W91-06502 2E

Low Flow Analysis.
W91-06505 2E

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING.
Psychrophilic Anaerobic Digestion of Animal Manure: Proposed Design Methodology.
W91-06225 5D

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF CROP SCIENCE.
Transformation of Alachlor by Microbial Communities.
W91-06829 7B

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF SOIL SCIENCE.
Soil Erosion Studies in Peru.
W91-06277 4D

NORTH CAROLINA UNIV. AT CHAPEL HILL. INST. OF MARINE SCIENCES.
Morphology, Sedimentology, and Tidal Channel Processes on a High-Tide-Range Mudflat, West Coast of South Korea.
W91-06816 2L

NORTH CENTRAL FOREST EXPERIMENT STATION, GRAND RAPIDS, MN. FORESTRY SCIENCES LAB.
Effect of Aspen Harvest and Growth on Water Yield in Minnesota.
W91-06563 4C

NORTH CENTRAL FOREST EXPERIMENT STATION, RHINELANDER, WI. FORESTRY SCIENCES LAB.
Using Lake Trout as a Surrogate of Ecosystem Health for Oligotrophic Waters of the Great Lakes.
W91-06923 5A

NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF ZOOLOGY.
Indirect Effects of Fish Predation on Calcite Supersaturation, Precipitation and Turbidity in a Shallow Prairie Lake.
W91-06271 2H

NORTH TEXAS STATE UNIV., DENTON. DEPT. OF BIOLOGICAL SCIENCES.
Behavioral Reactions for the Assessment of Stress in Fishes.
W91-06919 5A

Whole-Animal Physiological Processes for the Assessment of Stress in Fishes.
W91-06921 5A

NORTHEASTERN FOREST EXPERIMENT STATION, DURHAM, NH. FORESTRY SCIENCES LAB.
Effects of Whole-Tree Clearcutting on Streamflow Can Be Adequately Estimated by Simulation.
W91-06564 4C

NORTHEASTERN UNIV., BOSTON, MA. DEPT. OF BIOLOGY.
Production and Life Cycle of the Gastropod Hydrobia truncata, with Notes on Spurwinkia salsa in Massachusetts Salt Marsh Pools.
W91-06844 2L

NORTHERN ARIZONA UNIV., FLAGSTAFF. DEPT. OF BIOLOGY.
Influence of Various Exposure Periods on the Biomass and Chlorophyll a of Cladophora glomerata (Chlorophyta).
W91-06248 2H

NORTHLAND RESEARCH, INC., FLAGSTAFF, AZ.
Investigations at the Cake Ranch Site: A Classic Period Hohokam Village in the Lower Santa Cruz River Basin, Pinal County, Arizona.
W91-07046 6G

NOTTINGHAM POLYTECHNIC (ENGLAND). DEPT. OF PHYSICAL SCIENCES.
Concentration and Determination of Trace Amounts of Chlorinated Pesticides in Aqueous Samples.
W91-07017 5A

NSI TECHNOLOGY SERVICES CORP., CORVALLIS, OR.
Short-Term Amphibian Toxicity Tests and Paraquat Toxicity Assessment.
W91-06704 5C

NTH CONSULTANTS, EXTON, PA.
Physical Testing Program for Stabilized Metal Hydroxide Sludges.
W91-06142 5E

NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC. LOW-LEVEL WASTE LICENSING BRANCH.
Nuclear Regulatory Commission Regulations and Experience with Solidification/Stabilization Technology.
W91-06132 5E

NUCLEAR WASTE RESEARCH GROUP, FUEL CYCLE ANALYSIS DIVISION, BROOKHAVEN NATIONAL LABORATORY, ASSOCIATED UNIVERSITY, INC., UPTON NY 11973.
Process for Solidifying Sodium Nitrate Waste in Polyethylene.
W91-06130 5E

OAK RIDGE GASEOUS DIFFUSION PLANT, TN.
Treatment and Disposal Options for a Heavy Metals Waste Containing Soluble Technetium-99.
W91-06675 5D

OAK RIDGE NATIONAL LAB., TN.
Magnetic Separation of Uranium from Waste Materials.
W91-06173 5D

OAK RIDGE NATIONAL LAB., TN. CHEMICAL TECHNOLOGY DIV.
Systematic Approach for the Design of Pumpable, Cement-Based Grouts for Immobilization of Hazardous Wastes.
W91-06126 5E

In Situ Grouting of Shallow Landfill Radioactive Waste Trenches.
W91-06157 5E

Minimizing Waste by Charging the Generator.
W91-06161 5E

Evaluation of a Cell-Biopolymer Sorbent for Uptake of Strontium from Dilute Solutions.
W91-06666 5D

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Summer Habitat Suitability for Striped Bass in Chesapeake Bay: Reflections on a Population Decline.
W91-06038 2L

Hepatic Enzymes as Biomarkers: Interpreting the Effects of Environmental, Physiological and Toxicological Variables.
W91-06181 5A

Biological Monitoring: Testing for Genotoxicity.
W91-06183 5A

Application of Bioindicators in Assessing the Health of Fish Populations Experiencing Contaminant Stress.
W91-06191 5A

Use of Biomarkers in Ecological Risk Assessment.
W91-06193 5A

Pre-Exposure to 3-Methylcholanthrene Increases Benzo(a)pyrene Adducts on DNA of Bluegill Sunfish.
W91-06368 5C

Use of Bioindicators for Assessing the Effects of Pollutant Stress on Fish.
W91-06385 5A

Environmental Risk Assessment/Environmental Hazard Assessment: Similarities and Differences.
W91-06692 5C

DNA Damage as an Indicator of Pollutant-Induced Genotoxicity.
W91-06715 5C

Critical Appraisal of Population Approaches in Assessing Fish Community Health.
W91-06922 5A

Effort-Allocation Analysis of the Seven-Day Fathead Minnow (Pimephales promelas) and Ceriodaphnia dubia Toxicity Tests.
W91-06996 5A

OAK RIDGE NATIONAL LAB., TN. HEALTH AND SAFETY RESEARCH DIV.
Protection of Human Health from Mixtures of Radionuclides and Chemicals in Drinking Water.
W91-06785 5C

OBAFEMI AWOLOWO UNIV., ILE-IFE (NIGERIA). DEPT. OF CIVIL ENGINEERING.
Soak-Away Systems and Possible Groundwater Pollution Problems in Developing Countries.
W91-06238 5B

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, CAYENNE (FRENCH GUIANA).
Runoff and Erosion in Clearings Following Cutting of the Humid Tropical Forest (Ecoulements et Erosion sous Prairies Artificielles apres Defrichement de la Foret Tropicale Humide).
W91-06521 4C

From the Plot to the Watershed: Scale Effect in the Amazonian Forest Ecosystem (De la Parcelle au Petit Bassin-Versant: Effet d'Echelle dans l'Ecosysteme Forestier Amazonien).
W91-06522 2B

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, MONTPELLIER (FRANCE).
Sediment Production and Transport on the Square Kilometre Scale in Humid Savannah, Ivory Coast (La Production de Sediments sur les Versants et Leur Transport a l'Echelle du Km-sq en Savane Humide, Cote d'Ivoire).
W91-07088 2J

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, PARIS (FRANCE).
European Network of Representative and Experimental Basins for Long-Term Monitoring of Water Resources.
W91-06499 7A

OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC. NATURAL RESOURCES DIV.
Agriculture's Role in Protecting Water Quality.
W91-06305 5G

OFFICE OF TECHNOLOGY ASSESSMENT, WASHINGTON, DC.
Waste Reduction Audits: Matching Types to Stages.
W91-06162 5E

OFFICE OF THE ASSISTANT CHIEF OF ENGINEERS (ARMY), WASHINGTON, DC.
Hazardous Waste Reduction Efforts in the Department of the Army.
W91-06159 5D

OFFICE OF THE NATIONAL ENVIRONMENT BOARD, BANGKOK (THAILAND). NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT CO-ORDINATION DIV.
Problems and Regulations in Pollution Control in Thailand.
W91-06899 5G

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER.
Reduce Greenhouse Runoff.
W91-06403 3F

OHIO STATE UNIV., COLUMBUS. DEPT. OF AGRONOMY.
Low-Resource Agriculture Alternatives in Sub-Saharan Africa.
W91-06114 3F

OHIO STATE UNIV., COLUMBUS. DEPT. OF AGRONOMY.

Sludge Metal Bioavailability.
W91-06448 5B

Effects of Slope Length, Slope Gradient, Tillage Methods and Cropping Systems on Runoff and Soil Erosion on a Tropical Alfisol: Preliminary Results.
W91-07066 4D

OHIO STATE UNIV., COLUMBUS. DEPT. OF ENTOMOLOGY.

PH Dependent Accumulation of PCP in Aquatic Microcosms with Sediment.
W91-06748 5B

Changes in the Toxicity of Three Pesticides as a Function of Environmental pH and Temperature.
W91-06886 5C

OHIO STATE UNIV., COLUMBUS. DEPT. OF MATERIALS SCIENCE AND ENGINEERING.

Adsorption Behavior of a Hydrophobic Polymeric Flocculant and Its Relation to Flocculation and Filtration Dewatering of Coal Slurries.
W91-06443 5D

OHIO STATE UNIV., COLUMBUS. DEPT. OF ZOOLOGY.

Effects of Sediment and the Route of Exposure on the Toxicity and Accumulation of Neutral Lipophilic and Moderately Water-Soluble Metabolizable Compounds in the Midge, Chironomus riparius.
W91-06701 5C

Great Lakes Estuaries.
W91-06846 2H

OHIO STATE UNIV., COLUMBUS. WATER RESOURCES CENTER.

Investigation of Sol Protection in Chemical Clarification.
W91-06440 5D

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ENGINEERING.

Indoor Soil Erosion Research Facility.
W91-06232 2J

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.

Soil-Water Relations and Interference between Devil's-Claw (Proboscidea louisianica) and Cotton (Gossypium hirsutum).
W91-06980 3F

OKLAHOMA UNIV., KINGSTON. BIOLOGICAL STATION.

Simple System of Replicated Recirculating Experimental Streams.
W91-06014 2H

OKLAHOMA WATER RESOURCES BOARD, OKLAHOMA CITY. WATER QUALITY DIV.

Physicochemical Factors Affecting the Abundance and Species Richness of Fishes in the Cimarron River.
W91-06278 2H

OLD DOMINION UNIV., NORFOLK, VA. DEPT. OF CHEMISTRY AND BIOCHEMISTRY.

Reactions of Aqueous Chlorine In vitro in Stomach Fluid from the Rat: Chlorination of Tyrosine.
W91-06911 5C

ONDO STATE UNIV., ADO-EKITI (NIGERIA). DEPT. OF GEOGRAPHY.

Morphology and Downstream Hydraulic Geometry Relations of Alluvial Stream Channels in a Humid Tropical Environment, Southwestern Nigeria.
W91-06485 2E

ONTARIO MINISTRY OF NATURAL RESOURCES, MAPLE. FISHERIES BRANCH.

Yield of Yellow Perch in Lakes Erie and St. Clair: Community Associations.
W91-06037 2H

Assessment and Management of Fish Community Health in the Great Lakes: Synthesis and Recommendations.
W91-06931 5A

ONTARIO MINISTRY OF NATURAL RESOURCES, THUNDER BAY. FISHERIES RESEARCH SECTION.

Ecosystem Health, a Human Perception: Definition, Detection, and the Dichotomous Key.
W91-06925 5G

ONTARIO MINISTRY OF THE ENVIRONMENT, REXDALE. LAB. SERVICES BRANCH.

Presence-Absence Test for Monitoring Drinking Water Quality.
W91-06213 5F

OREGON DEPT. OF FISH AND WILDLIFE, CLACKAMAS.

Management Implications of a Model of Predation by a Resident Fish on Juvenile Salmonids Migrating through a Columbia River Reservoir.
W91-06028 8I

OREGON DEPT. OF FISH AND WILDLIFE, CORVALLIS.

Community Structure, Distribution, and Standing Stock of Benthos, Epibenthos, and Plankton in the Columbia River Estuary.
W91-06285 2L

Species Composition, Distribution, and Invertebrate Prey of Fish Assemblages in the Columbia River Estuary.
W91-06286 2L

OREGON GRADUATE CENTER, BEAVERTON. DEPT. OF ENVIRONMENTAL SCIENCE AND ENGINEERING.

Response of Mesquite to Nitrate and Salinity in a Simulated Phreatic Environment: Water Use, Dry Matter and Mineral Nutrient Accumulation.
W91-06312 2B

OREGON STATE UNIV., CORVALLIS.

Geomorphic Influences on Sediment Transport in the Willamette River.
W91-06623 2J

OREGON STATE UNIV., CORVALLIS. AGRICULTURAL EXPERIMENT STATION.

Sweet Corn Yield and Tissue Metal Concentrations after Seven Years of Sewage Sludge Applications.
W91-06299 5E

OREGON STATE UNIV., CORVALLIS. COLL. OF FORESTRY.

Erosion and Sedimentation in the Pacific Rim.
W91-06570 2J

OREGON STATE UNIV., CORVALLIS. COLL. OF OCEANOGRAPHY.

Primary Production, Plant and Detrital Biomass, and Particle Transport in the Columbia River Estuary.
W91-06284 2L

OREGON STATE UNIV., CORVALLIS. DEPT. OF BOTANY AND PLANT PATHOLOGY.

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. I. Hydrology.
W91-06254 2E

Effects of Substrate Relief on the Distribution of Periphyton In Laboratory Streams. II. Interactions with Irradiance.
W91-06255 2E

OREGON STATE UNIV., CORVALLIS. DEPT. OF FOREST ENGINEERING.

Slackwater Habitat in Torrent-Impacted Streams.
W91-06636 2E

OREGON STATE UNIV., CORVALLIS. DEPT. OF SOIL SCIENCE.

Soil Water Balance Model for Partitioning Water Use among Crop Trees, Evaporation, and Competing Vegetation.
W91-06547 2G

OSLO UNIV. (NORWAY). DEPT. OF BIOLOGY.

Differential Effects of Mercurial Compounds on the Electroolfactogram (EOG) of Salmon (Salmo salar L).
W91-05998 5C

Metal-Binding in Polychaetes: Quantitative and Qualitative Studies of Five Species.
W91-06346 5B

OSLO UNIV. (NORWAY). DEPT. OF GEOGRAPHY.

Analysis of Time Variability in Recessions.
W91-06471 2E

Regional Hydrology: Applications of Information Technology.
W91-06508 2E

OSLO UNIV. (NORWAY). LAB. FOR FRESHWATER ECOLOGY AND INLAND FISHERIES.

NTNF--Programme on Environmental Impacts ('MVU'): Research and Reference Catchments Project ('FORSKREF').
W91-06507 4C

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF MICROBIOLOGY.

Comparison of the Roles of Direct Absorption and Phytoplankton Ingestion in Accumulation of Chromium by Sea Urchin Larvae.
W91-06265 5C

OTTAWA UNIV. (ONTARIO). DEPT. OF BIOLOGY.

Challenges in the Detection and Diagnosis of Pathological Change in Aquatic Ecosystems.
W91-06924 5A

OXFORD POLYTECHNIC (ENGLAND). DEPT. OF GEOGRAPHY.

Evolution of an Anthropogenic Desert Gully System.
W91-06721 2J

OXFORD UNIV. (ENGLAND). DEPT. OF METALLURGY.

Critical Review of Evaluation Procedures for Stabilization/Solidification Processes.
W91-06135 5E

PACIFIC FORESTRY CENTRE, VICTORIA (BRITISH COLUMBIA).

Carnation Creek, Canada--Review of a West Coast Fish/Forestry Watershed Impact Project.
W91-06560 4C

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, JUNEAU, AK. FORESTRY SCIENCES LAB.

Plant Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska.
W91-06032 2L

Effects of Timber Harvesting on Progressive Hillslope Deformation in Southwest Oregon.
W91-06587 2J

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, ARCATA, CA.
Overview: Channel Morphology and Sediment Transport in Steepland Streams.
W91-06616 2E

Measuring Sediment Yields of Storms Using PSALT.
W91-07092 2J

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CA.
Forest Harvest, Snowmelt and Streamflow in the Central Sierra Nevada.
W91-06536 4A

Snow Redistribution: Strip Cuts at Yuba Pass, California.
W91-06537 4A

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CA. SNOW HYDROLOGY PROJECT.
Water Release from a Forested Snowpack during Rainfall.
W91-06535 2C

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, RIVERSIDE, CA.
Postfire Sediment Movement by Debris Flows in the Santa Ynez Mountains, California.
W91-06611 2J

Post-Fire Response of a Boulder-Bed Channel.
W91-06612 2J

PAPUA NEW GUINEA UNIV., PORT MORESBY. DEPT. OF GEOGRAPHY.
Sedimentological Approach to Examining Sediments/Soils on Hillslopes: Examples from Papua New Guinea and Australia.
W91-06610 2J

PARKER AND AMCHEM, AMBLER, PA.
Source Reduction--Parts Cleaning.
W91-06682 5E

PATUXENT WILDLIFE RESEARCH CENTER, LAUREL, MD.
Effects of Mercury, Selenium, and Organochlorine Contaminants on Reproduction of Forster's Terns and Black Skimmers Nesting in a Contaminated Texas Bay.
W91-06773 5C

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. SCHOOL OF FOREST RESOURCES.
Aquatic Community Response to Stress: Prediction and Detection of Adverse Effects.
W91-06693 5C

PISA UNIV. (ITALY). DIPT. DI SCIENZE DELL'AMBIENTE E DEL TERRITORIO.
Micronucleus Assay in Anodonta cygnea for the Detection of Drinking Water Mutagenicity.
W91-06827 5A

PITTSBURGH CITY WATER DEPT. PA.
Legionella in Drinking Water.
W91-06210 5A

PITTSBURGH UNIV., PA.
Laser Desorption-Ionization FT-ICR Mass Spectrometry: DNA-Adduct Bases, Nucleosides and Nucleotides.
W91-06366 5C

PLYMOUTH MARINE LAB. (ENGLAND).
Comparison of Metal-Binding Proteins and Cadmium Metabolism in the Marine Molluscs Littorina littorea (Gastropoda), Mytilus edulis and Macoma balthica (Bivalvia).
W91-06350 5B

Metals in Gastropods--Metabolism and Bioreduction.
W91-06351 5B

Metabolic/Physiological Basis of Genotype-Dependent Mortality During Copper Exposure in Mytilus edulis.
W91-06357 5C

Uptake and Transformation of 14C-Labelled Tributyltin Chloride by the Dog-Whelk, Nucella lapillus: Importance of Absorption from the Diet.
W91-06358 5B

Structure of Vertical Current Profiles in a Macrotidal, Partly-Mixed Estuary.
W91-06832 2L

PLYMOUTH POLYTECHNIC (ENGLAND). DEPT. OF ENVIRONMENTAL SCIENCES.
Development of a Novel Multi-Element Detection System for Trace Metal Determination Based on Chemiluminescence After Separation by Ion Chromatography.
W91-07015 5A

PLYMOUTH POLYTECHNIC (ENGLAND). DEPT. OF GEOGRAPHICAL SCIENCES.
Preliminary Assessment of Soil Hydraulic Properties, and Their Implications for Agro Forestry Management in Grenada, West Indies.
W91-06549 2G

Impact of Conifer Afforestation on Water Quality in an Upland Catchment in Southwest England.
W91-06552 5C

POLK COUNTY BOARD OF COMMISSIONERS FOR ENVIRONMENTAL SERVICES, BARTOW, FL.
Distribution and Abundance of Larval Coquillettidia Perturbans in a Florida Freshwater Marsh.
W91-06824 2H

POLYTECHNIC SOUTH WEST, PLYMOUTH (ENGLAND). DEPT. OF ENVIRONMENTAL SCIENCES.
Widespread Occurrence of Highly Branched Acyclic C20, C25 and C30 Hydrocarbons in Recent Sediments and Biota -- A Review.
W91-06263 2K

POLYTECHNIC UNIV., BROOKLYN, NY.
First-Order Analysis of Open-Channel Flow.
W91-06297 8B

PORT HARCOURT UNIV. (NIGERIA). DEPT. OF GEOGRAPHY.
Management of Coastal Zone Erosion in Nigeria.
W91-06267 2J

PPG INDUSTRIES, INC., PITTSBURGH, PA.
Solvent Waste Minimization by the Coatings Industry.
W91-06683 5E

PRETORIA UNIV. (SOUTH AFRICA). DEPT. OF MEDICAL VIROLOGY.
Microbiology of Drinking Water Treatment: Reclaimed Wastewater.
W91-06203 5F

PROCTER AND GAMBLE CO., CINCINNATI, OH. ENVIRONMENTAL SAFETY DEPT.
Validation of a Four-Day Ceriodaphnia Toxicity Test and Statistical Considerations in Data Analysis.
W91-06994 5A

PSC ENGINEERS AND CONSULTANTS, INC., LANCASTER, PA.
Case History of Performance Test of the Carrousel Process at Easton, Pennsylvania.
W91-06914 5D

PTI ENVIRONMENTAL SERVICES, BELLEVUE, WA.
Comparative Sensitivity of Sediment Toxicity Bioassays at Three Superfund Sites in Puget Sound.
W91-06700 5A

PUBLIC WORKS RESEARCH INST., TSUKUBA (JAPAN).
Computer Simulations of Debris Flow Depositional Processes.
W91-06591 2J

PUBLIC WORKS RESEARCH INST., TSUKUBA (JAPAN). SABO DIV.
Ontake Landslide of September 14, 1984, in Japan.
W91-06585 2J

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF SOILS.
Efficiency of Nitrogen Use by Dryland Wheat in a Subhumid Region in Relation to Optimizing the Amount of Available Water.
W91-06417 3F

Simple Water-Balance Models for Simulating Moisture, Salinity and Sodicity Profiles in Soils under Wheat.
W91-06418 3F

PURDUE UNIV., LAFAYETTE, IN. SCHOOL OF HEALTH SCIENCES.
Study of Tritium Release from Encapsulated Titanium Tritide Accelerator Targets.
W91-06145 5B

QUEBEC UNIV., SAINTE-FOY.
Dynamics and Mass Balances of NO3(-) and SO4(-2) in Meltwater and Surface-Runoff during Spring Melt in a Boreal Forest.
W91-06513 5B

QUEEN MARY COLL., LONDON (ENGLAND). DEPT. OF GEOGRAPHY AND EARTH SCIENCE.
Terrain Analysis for Quantitative Description of Zero-Order Basins.
W91-06582 2J

QUEEN MARY COLL., LONDON (ENGLAND). SCHOOL OF BIOLOGICAL SCIENCES.
Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.
W91-05987 5B

QUEENSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF AGRICULTURE.
Contribution of Osmotic Adjustment to Grain Yield in Sorghum bicolor (L.) Moench under Water-Limited Conditions: I. Water Stress before Anthesis.
W91-06941 2I

RANGEN AQUACULTURE RESEARCH CENTER, HAGERMAN, ID.
Response of Diploid and Polyploid Rainbow Trout Cells Following Exposure to Genotoxic Compounds.
W91-06711 5C

READING UNIV. (ENGLAND). DEPT. OF PHYSIOLOGY AND BIOCHEMISTRY.
Interactive Effects of Pollutants at the Toxicokinetic Level--Implications for the Marine Environment.
W91-06395 5C

READING UNIV. (ENGLAND). DEPT. OF PURE AND APPLIED ZOOLOGY.
Convergence of Cellular Systems of Metal Detoxification.
W91-06353 5B

READING UNIV. (ENGLAND). J.J. THOMSON PHYSICAL LAB.
Electro-Optic Studies of Concentration Banding in Particulate Media.
W91-06426 5D

READING UNIV. (ENGLAND). POSTGRADUATE RESEARCH INST. FOR SEDIMENTOLOGY.
Salt-Marsh Growth and Stratification: A Numerical Model with Special Reference to the Severn Estuary, Southwest Britain.
W91-06815 2L

RECRA ENVIRONMENTAL, INC., AMHERST, NY.
What to Do with Hazardous Waste: Regulations, Management, and Disposal.
W91-06684 5G

REDWOOD NATIONAL PARK, ARCATA, CA.
Geomorphic and Hydrologic Conditions for Cold Pool Formation on Redwood Creek, California.
W91-06640 2E

Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California.
W91-06641 2J

Residence Times of Channel-Stored Sediment in Redwood Creek, Northwestern California.
W91-06642 2J

Field Methods Used for Monitoring Erosion and Sedimentation Processes in Steeplands of Northwestern California, USA.
W91-06654 7B

REDWOOD NATIONAL PARK, ORICK, CA.
Forested Block Slides in the Lower Redwood Creek Basin, Northwest California.
W91-06589 2J

Effects of Woody Debris Removal on Sediment Storage in a Northwest California Stream.
W91-06634 2J

REED, SMITH, SHAW AND MCCLAY, HARRISBURG, PA.
Pennsylvania's Superfund Law and Groundwater Management.
W91-06913 5G

REGION OF STORSTROM, PARKVEJ 37, DK-4800 NYKOBING F., DENMARK.
Environmental Studies of a Marine Wastewater Discharge from a Sulphite Pulp Mill--Example of a General Study Approach for Marine Industrial Discharges.
W91-06055 5B

RENSSELAER POLYTECHNIC INST., TROY, NY. DEPT. OF BIOLOGY.
Seasonal Variations in Bacterial Communities in Adirondack Streams Exhibiting pH Gradients.
W91-06022 2H

RHODE ISLAND UNIV., NARRAGANSETT. MARINE ECOSYSTEMS RESEARCH LAB.
Control of Nutrient Concentrations in the Seekonk-Providence River Region of Narragansett Bay, Rhode Island.
W91-06838 2L

RHODES UNIV., GRAHAMSTOWN (SOUTH AFRICA). INST. OF FRESHWATER STUDIES.
Transported Material in a Small River with Multiple Impoundments.
W91-06272 2J

RIJKSINSTITUUT VOOR ZUIVERING VAN AFVALWATER, LELYSTAD (NETHERLANDS).
Historical and Present Day Management of the River Rhine.
W91-06051 5G

ROCKEFELLER UNIV., NEW YORK.
Peptide Synthesis Waste Reduction and Reclamation of Dichloromethane.
W91-06677 5D

ROCKEFELLER UNIV., NEW YORK. LAB. ANIMAL RESEARCH CENTER.
In Vitro Response of the Brown Bullhead Catfish Cell Line, BB, to Aquatic Pollutants.
W91-06781 5C

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, TEMPE, AZ. FORESTRY SCIENCES LAB.
Hydrodynamic and Fluvial Morphologic Processes: Implications for Fisheries Management and Research.
W91-06026 2E

ROYAL AEROSPACE ESTABLISHMENT, FARNBOROUGH (ENGLAND).
New Fast Response Instrument for Measuring Total Water Content from Aircraft.
W91-06111 7B

ROYAL FOREST DEPT., BANGKOK (THAILAND). CHEE WATERSHED RESEARCH STATION.
Amount of Runoff and Soil Losses from Various Land-use Sampling Plots in Sakolnakorn Province, Thailand.
W91-06532 4A

ROYAL FOREST DEPT., BANGKOK (THAILAND). WATERSHED MANAGEMENT DIV.
Sediment Yields and Surface Runoff from Six Types of Agroforestry at Mae-klong Watershed Research Station, Kanchanaburi, Thailand.
W91-06605 2J

Discharge and Suspended Sediment of the Upper Nan River, Nan Province, Thailand.
W91-06633 2J

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF BIOLOGICAL SCIENCES.
Effects of Mercury on the Feeding Behavior of the Mummichog, Fundulus heteroclitus from a Polluted Habitat.
W91-06239 5C

RUTGERS - THE STATE UNIV., PISCATAWAY, NJ. NELSON BIOLOGICAL LAB.
Mercury Inhibits the Transport of D-Glucose by the Intestinal Brush Border Membrane Vesicles of Fish.
W91-06359 5C

SAINT ANDREWS UNIV. (SCOTLAND). GATTY MARINE LAB.
Tolerance of Acid Waters by Native Brown Trout (Salmo Trutta L).
W91-07025 5C

SAINT DAVID'S UNIV. COLL., LAMPETER (WALES). CENTRE FOR RESEARCH INTO ENVIRONMENT AND HEALTH.
Application of Water-Quality Standards to UK Bathing Waters.
W91-05970 5G

SALVESEN (ROBERT H.) ASSOCIATES, RED BANK, NJ.
On-Site Reuse and Recycle of Solvents.
W91-06686 5D

Treatment: Solvent Wastestreams.
W91-06689 5D

SAN JOAQUIN VALLEY DRAINAGE PROGRAM, SACRAMENTO, CA.
Estimation of Shallow Ground-Water Quality in the Western and Southern San Joaquin Valley, California.
W91-07037 2F

SAN JOSE STATE UNIV., CA. DEPT. OF GEOLOGY.
Groundwater Contribution to the Nutrient Budget of Tomales Bay, California.
W91-06951 2F

SANDIA NATIONAL LABS., ALBUQUERQUE, NM. SOLAR THERMAL COLLECTOR TECHNOLOGY DIV.
Falling-Film and Glass-Tube Solar Photocatalytic Reactors for Treating Contaminated Water.
W91-06658 5D

SANTIAGO UNIV. (SPAIN). DEPT. DE ANALISIS QUIMICO Y BROMATOLOGIA-TOXICOLOGIA.
Identification and Determination of Halogenated Hydrocarbons in Waters of Galicia (N. W. Spain) by Headspace Gas-Chromatography.
W91-07013 5A

SANTIAGO UNIV. (SPAIN). DEPT. OF BIOCHEMISTRY.
Oxyradical Generation and Redox Cycling Mechanisms in Digestive Gland Microsomes of the Common Mussel, Mytilus edulis L.
W91-06362 5C

SAO PAULO UNIV., SAO CARLOS (BRAZIL). DEPT. DE HIDRAULICA E SANEAMENTO.
Some Factors Affecting Erosion of Bed Channels Protected with Riprap.
W91-07071 2J

SAO PAULO UNIV., SAO CARLOS (BRAZIL). ESCOLA DE ENGENHARIA.
Mathematical Model for Reservoir Silting.
W91-07062 2J

SASKATCHEWAN UNIV., SASKATOON. DEPT. OF GEOGRAPHY.
Bed Load Transfer and Channel Morphology in Braided Streams.
W91-06620 2J

SASKATCHEWAN UNIV., SASKATOON. DEPT. OF SOIL SCIENCE.
Estimating the Atterberg Limits of Southern Saskatchewan Soils from Texture and Carbon Contents.
W91-06405 8D

SAVANNAH RIVER ECOLOGY LAB., AIKEN, SC.
Genetic Damage in a Population of Slider Turtles (Trachemys scripta) Inhabiting a Radioactive Reservoir.
W91-06784 5C

SAVANNAH RIVER LAB., AIKEN, SC.
Effects of Heterogeneous Porous Geology on Groundwater Flow and Transport Modeling in Multiaquifer Systems.
W91-07053 2F

SAVANNAH RIVER LAB., AIKEN, SC. ENVIRONMENTAL SCIENCES DIV.
Tropical Source Water.
W91-06196 5F

SCIENCE APPLICATIONS INTERNATIONAL CORP., NARRAGANSETT, RI.
Using the DNA Alkaline Unwinding Assay to Detect DNA Damage in Laboratory and Environmentally Exposed Cells and Tissues.
W91-06369 5A

Comparative Study of the Differential Blood Cell Counts of Winter Flounder (Pseudopleuronectes americanus) Collected in New England.
W91-06374 5C

SCIENCE APPLICATIONS INTERNATIONAL CORP., RALEIGH, NC.
Modelling Salinity and Circulation for the Columbia River Estuary.
W91-06282 2L

SEOUL NATIONAL UNIV. (REPUBLIC OF KOREA). DEPT. OF FORESTRY.
Soil Losses and Runoff Rates from the Forested Watersheds in Korea.
W91-06603 2J

SETSUNAN UNIV., NEYAGAWA (JAPAN). DEPT. OF CIVIL ENGINEERING.
Management and Status of Japanese Public Waters.
W91-06039 5G

Water Quality Management in the Yodo River Basin--Case Study.
W91-06046 5G

SEVERN-TRENT WATER AUTHORITY, SOLIHULL (ENGLAND). RIVERS AND REGULATION DIV.
Estimation of River Flows with Particular Reference to Natural and Artificial Components.
W91-06496 2E

SHIGA PREFECTURAL INST. OF PUBLIC HEALTH AND ENVIRONMENTAL SCIENCE, OTSU (JAPAN).
Accumulation and Metabolism of 2,4,6-Trichlorophenyl-4'-Aminophenyl Ether by Carp.
W91-07019 5B

Bioconcentration and Excretion of Diazinon, IBP, Malathion and Fenitrothion by Carp.
W91-07020 5B

SHIN-NIHON CHEMICAL INDUSTRY CO. LTD., TOKYO (JAPAN).
Removal of Fluoride Ion from Wastewater by a Hydrous Cerium Oxide Adsorbent.
W91-06665 5D

SHIP RESEARCH INST., TOKYO. SHIP EQUIPMENT DIV.
Present Situation and Problems Related to Marine Oily-Water Separating Techniques.
W91-06074 5G

SHIZUOKA UNIV. (JAPAN). DEPT. OF FORESTRY.
Forest Distribution Used as an Erosion Indicator on Large-Scale Landslide Scars.
W91-06588 2J

SHIZUOKA UNIV. (JAPAN). LAB. OF FOOD HYGIENE.
Croaker (Nibea mitsukurii) and the Sea Catfish (Plotosus anguillaris): Useful Biomarkers of Coastal Pollution.
W91-06179 5A

SIENA UNIV. (ITALY). DIPT. DI BIOLOGIA AMBIENTALE.
Mixed-Function Oxidase Activity and Conjugating Enzymes in Two Species of Antarctic Fish.
W91-06328 5B

Seasonal Variation of Mixed-Function Oxidase Activity in a Population of Yellow-Legged Herring Gull: Relationship to Sexual Cycle and Pollutants.
W91-06329 5C

SILSOE COLL. (ENGLAND). DEPT. OF FIELD ENGINEERING.
Effect of Different Types of Forest Management on the Transformation of Rainfall Energy by the Canopy in Relation to Soil Erosion.
W91-06530 4A

SIMON FRASER UNIV., BURNABY (BRITISH COLUMBIA). DEPT. OF BIOLOGICAL SCIENCES.
Acute Physiological Stress Responses of Juvenile Coho Salmon (Oncorhynchus kisutch) to Sublethal Concentrations of Garlon 4, Garlon 3A, and Vision Herbicides.
W91-06998 5C

SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
Metabolism and Accumulation of Xenobiotics Within Hepato-pancreas Cells of the Blue Crab, Callinectes sapidus.
W91-06336 5B

SLOVENSKA AKADEMIA VIED, BRATISLAVA (CZECHOSLOVAKIA). USTAV HYDROLOGIE A HYDRAULIKY.
Determination of Critical Moisture Contents of Soils in the Course of Evapotranspiration.
W91-05981 2D

Hydrology of Mountainous Areas: Scientific Problem and a Field of Internationally Coordinated Research.
W91-06478 2E

SOFIA UNIV. (BULGARIA). DEPT. OF GEOPHYSICS.
Mechanisms of the Black Sea Circulation.
W91-06410 2B

SOLVENT RESOURCE RECOVERY, INC., WEST CARROLTON, OH.
Commercial (Off-Site) Solvent Reclamation.
W91-06687 5D

SOUTH AFRICAN FORESTRY RESEARCH INST., SABIE.
Estimating Water Use by Eucalyptus grandis with the Penman-Monteith Equation.
W91-06541 2D

SOUTH CAROLINA UNIV., COLUMBIA. MARINE SCIENCE PROGRAM.
Rediversion Salinity Change in the Cooper River, South Carolina: Ecological Implications.
W91-06834 2L

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF PLANT SCIENCE.
Adsorption and Desorption of Atrazine, Hydroxyatrazine, and S-Glutathione Atrazine on Two Soils.
W91-06989 5B

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF WILDLIFE AND FISHERIES.
Importance of Emergent Vegetation in Reducing Sediment Resuspension in Wetlands.
W91-06017 2H

SOUTHAMPTON UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Comparison of the Sediment Transport and Yield Characteristics of Two Adjacent Glacier Basins, Val d' Herens, Switzerland.
W91-07103 2J

SOUTHEASTERN FOREST EXPERIMENT STATION, OTTO, NC.
Microbial Incorporation of Sulfate into Organic Matter in Forest Soils.
W91-06511 5B

SOUTHERN FOREST EXPERIMENT STATION, PINEVILLE, LA.
Growth of Slash Pine Planted in Soil Disturbed by Wet-Weather Logging.
W91-06275 4C

SOUTHERN WATER SERVICES LTD., ISLE OF WIGHT DIVISION, ENGLAND.
Isle of Wight Water Metering Trial.
W91-05966 3F

SRI LANKA UNIV., PERADENIYA. HYDRAULICS LAB.
Optimal Filtering Techniques in Flood Forecasting.
W91-06464 2E

STANFORD UNIV., CA. DEPT. OF MICROBIOLOGY AND IMMUNOLOGY.
Effect of Starvation on Bacterial Resistance to Disinfectants.
W91-06198 5F

STATE UNIV. OF NEW YORK AT BROOKLYN.
Effects of Measurement Error on Previously Reported Mathematical Relationships Between Indicator Organism Density and Swimming-Associated Illness: A Quantitative Estimate of the Resulting Bias.
W91-06917 7C

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING.
Dechlorination of Chlorendic Acid with Ozone.
W91-06868 5D

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF GEOGRAPHY.
Field Experiments on the Resistance to Overland Flow on Desert Hillslopes.
W91-06718 2E

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
Groundwater Seepage along a Barrier Island.
W91-06954 2F

STATE UNIV. OF NEW YORK AT SYRACUSE. COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY.
Sulfur Dynamics in Mineral Horizons of Two Northern Hardwood Soils: A Column Study with S35.
W91-06948 2G

STATE UNIV. OF NEW YORK COLL. AT BUFFALO. GREAT LAKES LAB.
Comparative Metabolism of Benzo(a)pyrene and (-) Benzo(a)pyrene-7,8-dihydrodiol by Hepatocytes Isolated from Two Species of Bottom-Dwelling Fish.
W91-06344 5C

STATE UNIV. OF NEW YORK, SYRACUSE. COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY.
Effect on Mutagenicity of the Stepwise Removal of Hydroxyl Group and Chlorine Atoms from 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone: 13C NMR Chemical Shifts as Determinants of Mutagenicity.
W91-06910 5C

STATIUNEA DE CERCETARI STEJARUL, PIATRA-NEAMT (ROMANIA). GEOMORPHOLOGY LAB.
Relationship Between Sediment Delivery Ratio and Stream Order: a Romanian Case Study.
W91-06722 2J

STEVENS INST. OF TECH., HOBOKEN, NJ. DEPT. OF CIVIL, ENVIRONMENTAL AND COASTAL ENGINEERING.
Effect of Buoyancy on Transverse Mixing in Streams.
W91-07030 5B

STIRLING UNIV. (SCOTLAND). DEPT. OF ECONOMICS.

STIRLING UNIV. (SCOTLAND). DEPT. OF ECONOMICS.
Economics of Nitrate Pollution.
W91-06790 5C

STIRLING UNIV. (SCOTLAND). DEPT. OF ENVIRONMENTAL SCIENCE.
Forestry and Sediment Yields in Upland Scotland.
W91-06649 2J

STIRLING UNIV. (SCOTLAND). INST. OF AQUACULTURE.
Fish Metallothioneins: Molecular Cloning Studies and Induction in Cultured Cells.
W91-06347 5C

STONE AND WEBSTER WATER TECHNOLOGY SERVICES, FORT LAUDERDALE, FL.
Membrane Softening: A Treatment Process Comes of Age.
W91-06810 5F

STRANCO, INC., BRADLEY, IL.
Importance of Flocculant Preparation for Use in Solid/Liquid Separation.
W91-06441 5D

STRASBOURG-1 UNIV. (FRANCE). INST. DE GEOLOGIE.
Forest Influence on the Surface Water Chemistry of Granitic Basins Receiving Acid Precipitation in the Vosges Massif, France.
W91-06520 5B

STRATHCLYDE REGIONAL COUNCIL, GLASGOW (SCOTLAND). WATER DEPT.
Drinking Water Directive and Proposed Water Supply (Water Quality) Regulations for Scotland.
W91-05974 5G

SUPPORT GROUP, FREMONT, CA.
3-D Mapping of Dissolved Oxygen in Mar Piccolo: A Case Study.
W91-06802 5C

SVERIGES LANTBRUKSUNIVERSITET, UPPSALA. DEPT. OF SOIL SCIENCES.
Mobility in Sandy Soils of Four Pesticides with Different Water Solubility.
W91-06397 5B

SVERIGES LANTBRUKSUNIVERSITET, UPPSALA. DIV. OF WATER MANAGEMENT.
Leaching Potential and Decomposition of Fluroxypyr in Swedish Soils under Field Conditions.
W91-06794 5B

SVERIGES LANTBRUKSUNIVERSITET, UPPSALA. INST. OF ECONOMICS.
Costs for Reducing Farmers' Use of Nitrogen in Gotland, Sweden.
W91-06107 5G

SVERIGES METEOROLOGISKA OCH HYDROLOGISKA INST., NORRKOEPING.
Tests and Application of Soil Moisture Deficit Models Used for Analysis of Basin Behaviour.
W91-06489 2E

SWEDISH ENVIRONMENTAL RESEARCH INST., STOCKHOLM.
Effects of Phthalate Esters on the Locomotor Activity of the Freshwater Amphipod Gammarus pulex.
W91-05990 5C

TAIWAN FORESTRY RESEARCH INST., TAIPEI. WATERSHED MANAGEMENT DIV.
Analysis and Application of Experimental and Network Data for Defining Hydrologic Characteristics of Upstream Forested Watersheds.
W91-06474 2E

TAMIL NADU AGRICULTURAL UNIV., COIMBATORE (INDIA). DEPT. OF AGRICULTURAL ECONOMICS.
Influence of Irrigation with Pulp and Paper Mill Effluent on Soil Chemical and Microbiological Properties.
W91-06788 5E

TECHNICAL UNIV. OF DENMARK, LYNGBY. DEPT. OF ENVIRONMENTAL ENGINEERING.
Hydrolysis of Particulate Substrate by Activated Sludge Under Aerobic, Anoxic and Anaerobic Conditions.
W91-06865 5D

TECHNISCHE HOCHSCHULE AACHEN (GERMANY, F.R.). INST. FUER SIEDLUNGSWASSERWIRTSCHAFT.
Identification of Non-Biodegradable, Hydrophilic, Organic Substances in Industrial and Municipal Waste Water Treatment Plant-Effluents by Liquid Chromatography-Tandem Mass Spectrometry (LC/MS/MS).
W91-06076 5D

TECHNISCHE UNIV. BRAUNSCHWEIG (GERMANY, F.R.). INST. FUER GEOGRAPHIE.
Runoff Formation Concept to Model Water Pathways in Forested Basins.
W91-06559 2E

TECHNISCHE UNIV., DRESDEN (GERMAN D.R.). DEPT. OF WATER SCIENCES.
Computer-Aided Analysis of Flow Recessions and Coupled Basin Water Balance Investigations.
W91-06470 2E

TECHNISCHE UNIV. MUENCHEN (GERMANY, F.R.). LEHRSTUHL UND PRUEFAMT FUER WASSERGUETEWIRTSCHAFT UND GESUNDHEITSINGENIEURWESEN.
Tracing the Influx of Sewage from a Leaky Sewer into a Very Thin and Fast-Flowing Aquifer.
W91-06867 5B

TEHRAN UNIV. (IRAN). SCHOOL OF PHARMACY.
Biological Survey of Ground Water from the Tehran Plain, Iran.
W91-06901 2F

TENNESSEE COOPERATIVE FISHERY RESEARCH UNIT, COOKEVILLE.
Current Distribution and Status of the Upper Cumberland River Johnny Darter, Etheostoma nigrum susanae.
W91-06019 2H

TENNESSEE UNIV., KNOXVILLE. COLL. OF VETERINARY MEDICINE.
Comparative Developmental Toxicity of Acetylenic Alcohols on Embryos and Larvae of Xenopus laevis.
W91-06709 5C

TENNESSEE UNIV., KNOXVILLE. DEPT. OF ORNAMENTAL HORICULTURE AND LANDSCAPE DESIGN.
Turgor Maintenance in Rosa rugosa Grown at Three Levels of Nitrogen and Subjected to Drought.
W91-06918 3F

TENNESSEE VALLEY AUTHORITY, MUSCLE SHOALS, AL. ATMOSPHERIC SCIENCE DEPT.
Tests of Models of Cloudwater Deposition to Forest Canopies Using Artificial and Living Collectors.
W91-06876 2B

TENNESSEE VALLEY AUTHORITY, NORRIS. ENGINEERING LAB.
Cubic-Spline Interpolation in Lagrangian Advection Computation.
W91-06298 5B

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS.
Energy, Water, and Economic Savings of Improved Production Systems on the Texas High Plains.
W91-06402 3F

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF WILDLIFE AND FISHERIES SCIENCES.
Deterministic Model of the Response of Threadfin Shad to Aquatic Macrophyte Control.
W91-06015 4A

TEXAS CHRISTIAN UNIV., FORT WORTH. DEPT. OF BIOLOGY.
Effects of Light and Wave Disturbance on Vertical Zonation of Attached Microalgae In a Large Reservoir.
W91-06250 2H

TEXAS UNIV. AT AUSTIN. DEPT. OF CIVIL ENGINEERING.
Supercritical Water Oxidation--Wastewaters and Sludges.
W91-06081 5D

Sorption of Polycyclic Aromatic Hydrocarbons onto Natural Solids: Determination by Fluorescence Quenching Method.
W91-06086 5B

Sorption Kinetics of Non-Ionic Organic Pollutants onto Suspended Sediments.
W91-06088 5B

TEXAS UNIV., PORT ARANSAS. MARINE SCIENCE INST.
Effects of Aroclor 1254 and Cadmium on Reproductive Endocrine Function and Ovarian Growth in Atlantic Croaker.
W91-06392 5C

THESSALONIKI UNIV., SALONIKA (GREECE). INST. OF BOTANY.
Uptake of Cu, Cd, Zn and Pb in Posidonia oceanica (Linneaus) from Antikyra Gulf, Greece: Preliminary Note.
W91-06391 5B

THOMAS JEFFERSON UNIV., PHILADELPHIA, PA. DEPT. OF ANATOMY.
Enzyme Modulation by Sublethal Concentrations of Aldicarb, Phosphamidon, and Endosulfan in Fish Tissues.
W91-07006 5C

THU-THAI ASSOCIATES, INC., TAIPEI (TAIWAN).
Erosional Effects of Road Construction in Pi-Lu Experimental Watershed.
W91-06608 2J

TIME-LAPSE SYSTEMS, INC., SEATTLE, WA.
Time-Lapse Streamflow over North America.
W91-06509 2E

TOKYO INST. OF TECH. (JAPAN). DEPT. OF CHEMISTRY.
Stabilization of Hazardous Materials into Ferrites.
W91-06082 5E

TOKYO INST. OF TECH. (JAPAN). RESEARCH LAB. OF RESOURCES UTILIZATION.
Method for Monitoring the Decomposition Process in Soil of Organic Wastewaters with High Strength and Low C/N Ratio.
W91-06978 5E

TOKYO UNIV. (JAPAN). DEPT. OF BOTANY.
Fungal Control of Population Changes of the Planktonic Diatom Asterionella formosa In a Shallow Eutrophic Lake.
W91-06247 2H

TOKYO UNIV. (JAPAN). DEPT. OF URBAN AND SANITARY ENGINEERING.
Perspective of Water Resources in Japan and in the World.
W91-06040 6D

TOKYO UNIV. (JAPAN). OCEAN RESEARCH INST.
Method for Detecting and Identifying the Lethal Environmental Factor on a Dominant Macrobenthos and Its Application to Lake Shinji, Japan.
W91-06260 5A

TOKYO UNIV. OF AGRICULTURE AND TECHNOLOGY (JAPAN). DEPT. OF ENVIRONMENTAL SCIENCE AND CONSERVATION.
Linear Alkylbenzenes (LABs) in Urban Riverine and Coastal Sediments and Their Usefulness as a Molecular Indicator of Domestic Wastes.
W91-06087 5B

TOKYO UNIV. OF AGRICULTURE AND TECHNOLOGY (JAPAN). DEPT. OF FORESTRY.
Evaluation of the Effect of Deforestation on Slope Stability and Its Application to Watershed Management.
W91-06527 2J

Hydrogeomorphological Characteristics of a Zero-Order Basin.
W91-06576 2E

TORONTO UNIV. (ONTARIO). DEPT. OF BOTANY.
Effects of Arsenate on Growth of Nitrogen- and Phosphorus-Limited Chlorella vulgaris (Chlorophyceae) Isolates.
W91-06256 5C

TORONTO UNIV. (ONTARIO). DEPT. OF CHEMICAL ENGINEERING AND APPLIED CHEMISTRY.
Direct In Situ Sensing of the Fugacity of Hydrophobic Chemicals in Natural Waters.
W91-06992 5B

TORONTO UNIV. (ONTARIO). DEPT. OF CHEMISTRY.
Electrochemical Reactor Systems for Metal Recovery and Detoxification of Industrial Effluents.
W91-06455 5D

TORONTO UNIV. (ONTARIO). DEPT. OF GEOGRAPHY.
Estimation of Colluvial Reservoir Life from Sediment Budgeting, Katiorin Experimental Basin, Kenya.
W91-07114 2J

TORONTO UNIV. (ONTARIO). DEPT. OF MECHANICAL ENGINEERING.
Drownproofing of Low Overflow Structures.
W91-06294 8B

TORONTO UNIV. (ONTARIO). INST. FOR ENVIRONMENTAL STUDIES.
Copper Tolerance of Chlamydomonas acidophila (Chlorophyceae) Isolated from Acidic, Copper-Contaminated Soils.
W91-06258 5C

TOXIC TREATMENTS (USA), INC., SAN FRANCISCO, CA.
In-Situ Hot Air/Steam Extraction of Volatile Organic Compounds.
W91-06447 5G

TOYAMA PREFECTURAL COLL. OF TECHNOLOGY, KOSUGI (JAPAN).
Conservation of Fish Habitat in Streams by the Method of Low Dams Series.
W91-06637 8I

TRENT UNIV., PETERBOROUGH (ONTARIO). ENVIRONMENTAL CENTRE.
Cadmium Concentrations in the Freshwater Mussel (Elliptio complanata) and Their Relationship to Water Chemistry.
W91-06783 5B

TREVECCA NAZARENE COLL., NASHVILLE, TN.
Elution of Endrin through Compacted Soil with Ethanol-Water Mixtures.
W91-06021 5B

TRICIL ENVIRONMENTAL SERVICES, ANTIOCH, TN.
Soliroc Process in North America: A Stabilization/Solidification Technology for the Treatment of Metal-Bearing Wastes with Reference to Extraction Procedure Toxicity Testing.
W91-06125 5D

TRIER UNIV. (GERMANY, F.R.). ANGEWANDTE PHYSISCHE GEOGRAPHIE, FACH FERNERKUNDUNG.
Seasonal Variations of Runoff Rates From Field Plots in the Federal Republic of Germany and in Hungary During Dry Years.
W91-06728 2E

TSUKUBA UNIV. (JAPAN). INST. OF GEOSCIENCE.
Erosion and Sedimentation Caused by Typhoons in 1982 in the Amahata River Basin, Japan.
W91-06646 2J

TUFTS UNIV., BOSTON, MA. SCHOOL OF VETERINARY MEDICINE.
Prevalence of Leukemia in Hemolymph of Soft-Shell Clams, Mya arenaria, in Dorchester Bay, Boston Harbor.
W91-06373 5C

UKAEA ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL (ENGLAND).
Quality-Assurance Procedure for Use at Treatment Plants to Predict the Long-Term Suitability of Cement-Based Solidified Hazardous Wastes Deposited in Landfill Sites.
W91-06134 5E

ULSTER UNIV. AT JORDANSTOWN, NEWTOWNABBEY (NORTHERN IRELAND). DEPT. OF COMPUTING SCIENCE.
Role of Instrument Type and Errors in the Construction of Catchment Water Balances.
W91-06466 2E

UNIT OF AQUATIC BIOCHEMISTRY, STIRLING (SCOTLAND).
Fish and Mammalian Liver Cytosolic Glutathione S-Transferases: Substrate Specificities and Immunological Comparison.
W91-06330 5C

Activities of Pollutant Metabolising and Detoxication Systems in the Liver of the Plaice, pleuronectes Platessa: Sex and Seasonal Variations in Non-Induced Fish.
W91-07022 5B

UNIVERSIDAD AUTONOMA DE BAJA CALIFORNIA, MEXICALI (MEXICO). INST. DE INVESTIGACIONES OCEANOLOGICAS.
DDT in Mytilus edulis: Spatio-Temporal Variations, in the Punta Banda Estuary, Baja California, Mexico.
W91-06883 5B

UNIVERSIDAD DE ALCALA DE HENARES, MADRID (SPAIN). DEPT. OF GEOLOGY.
Land Applications: Its Effectiveness in Purification of Urban and Industrial Wastewaters in La Mancha, Spain.
W91-06799 5D

UNIVERSIDAD DE EXTREMADURA, BADAJOZ (SPAIN). DEPT. DE HORTOFRUTICULTURA.
Evaporation Measurements beneath Corn, Cotton, and Sunflower Canopies.
W91-06400 2D

UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO, MEXICO CITY. FACULTAD DE INGENIERIA.
Suspended Sediment Routing along a Reservoir.
W91-07070 2J

UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO, MEXICO CITY. INST. DE INGENIERIA.
Flow in Damaged Pipe Networks.
W91-06296 8A

UNIVERSIDAD POLITECNICA DE MADRID (SPAIN). ESCUELA TECNICA SUPERIOR DE INGENIEROS AGRONOMOS.
Characterization and Classification of Tidal Marsh Soils and Plant Communities in North-West Spain.
W91-06905 2L

UNIVERSIDADE FEDERAL DA PARAIBA, CAMPINA GRANDE (BRAZIL). DEPT. OF CIVIL ENGINEERING.
Erosion Studies in Sume, a Semiarid Region in the Northeast of Brazil.
W91-07091 2J

UNIVERSIDADE FEDERAL DO RIO DE JANEIRO (BRAZIL). DEPT. DE GEOGRAFIA.
Gullying in the Southeastern Brazilian Plateau, Bananal, SP.
W91-07061 2J

UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL, PORTO ALEGRE (BRAZIL). INST. DE RECHERCHES HYDRAULIQUES.
Stream Power and Sediment Deposition in Flowing Water (Puissance Hydraulique et Depot de Sediments en Eaux Courantes).
W91-07060 2J

Selection of Representative and Experimental Basins for the Study of Erosion on the South American Plateau (Choix de Bassins Representatifs et Experimentaux pour l'Etude de l'Erosion sur le Plateau Basaltique Sudamericain).
W91-07075 2J

Preliminary Estimate of Bed Load Using Mean Grain Size Distribution Data.
W91-07089 2J

Analysis of the Quality of Suspended Sediment Data.
W91-07090 2J

UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL, PORTO ALEGRE (BRAZIL). INST.

Evaluation of the Risks of Erosion and Sedimentation in Brazil from Rough Sediment Budgets (Evaluation des Risques d'Erosion et de Sedimentation au Bresil a Partir de Bilans Sedimentologiques Rudimentaires).
W91-07096 2J

UNIVERSITAET DER BUNDESWEHR MUENCHEN, NEUBIBERG (GERMANY, F.R.). INST. FOR HYDROMECHANICS.

Simulation Model for the Computation of Sediment Yield Due to Upland and Channel Erosion from a Large Basin.
W91-07105 2J

UNIVERSITAT DE LES ILLES BALEARS, PALMA DE MALLORCA (SPAIN). DEPT. DE BIOLOGIA Y CIENCIAS DE SALUD.

Chemical Hydrology and Macrophyte Vegetation in the Canals of a Mediterranean Coastal Marsh.
W91-06755 2L

UNIVERSITE NATIONALE DU BENIN, COTONOU. DEPT. DE MATHEMATIQUES.

Consistent Scale Parameter for Hydrological Studies.
W91-06473 2E

UNIVERSITY COLL., CAMPBELL (AUSTRALIA). DEPT. OF GEOGRAPHY AND OCEANOGRAPHY.

Examination of the Role of Sampling Strategies in the Study of Suspended Sediment Transport.
W91-07086 2J

UNIVERSITY COLL., CARDIFF (WALES). DEPT. OF BIOCHEMISTRY.

Comparison of the Accumulation, Tissue Distribution and Secretion of Cadmium in Different Species of Freshwater Fish.
W91-07021 5B

UNIVERSITY COLL., CARDIFF (WALES). SCHOOL OF PURE AND APPLIED BIOLOGY.

Relationships between the Physicochemistry and Macroinvertebrates of British Upland Streams: The Development of Modelling and Indicator Systems for Predicting Fauna and Detecting Acidity.
W91-06269 5A

Influence of Plantation Forestry on the pH and Aluminium Concentration of Upland Welsh Streams: A Re-Examination.
W91-06806 2K

UNIVERSITY COLL., DUBLIN (IRELAND). DEPT. OF ENVIRONMENTAL RESOURCE MANAGEMENT.

Aspects of the Nitrogen Cycle in Peatland and Plantation Forest Ecosystems in Western Ireland.
W91-06321 2H

UNIVERSITY OF CENTRAL FLORIDA, ORLANDO. ENVIRONMENTAL SYSTEMS ENGINEERING INST.

Cost and Performance of a Membrane Pilot Plant.
W91-06811 5F

UNIVERSITY OF NEW ENGLAND, ARMIDALE (AUSTRALIA). DEPT. OF RESOURCE ENGINEERING.

Estimating Erosion Using Caesium-137: I. Measuring Caesium-137 Activity in a Soil.
W91-07082 2J

Estimating Erosion Using Caesium-137: II. Estimating Rates of Soil Loss.
W91-07083 2J

UNIVERSITY OF PETROLEUM AND MINERALS, DHAHRAN (SAUDI ARABIA). RESEARCH INST.

Chemistry of Atmospheric Precipitation at the Western Arabian Gulf Coast.
W91-06873 5C

Survey of Saudi Arabian Drinking Water for Trihalomethanes.
W91-06896 5A

UNIVERSITY OF SOUTH FLORIDA, TAMPA. COLL. OF PUBLIC HEALTH.

Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources.
W91-06862 3C

UNIVERSITY OF SOUTH FLORIDA, TAMPA. DEPT. OF CIVIL ENGINEERING AND MECHANICS.

Efficiencies in Waste Processing.
W91-06171 5D

UNIVERSITY OF SOUTH FLORIDA, TAMPA. DEPT. OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH.

Occurrence and Control of Cryptosporidium in Drinking Water.
W91-06208 5F

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA).

Effects of Momentum Transfer in Compound Channels.
W91-07032 8B

UPAZILLA HEALTH COMPLEX, CHOUDDOGRAM, COMILLA, BANGLADESH.

Sanitation in Rural Communities in Bangladesh.
W91-05992 5D

UPPSALA UNIV. (SWEDEN). DEPT. OF ZOOPHYSIOLOGY.

Comparison of Absorption Rates of Halogenated Phenols Across Fish Gills in Fresh and Marine Water.
W91-06363 5B

Aluminium Inhibition of Calcium Carbonate Crystal Growth: In Vitro Studies Related to Shell-Repair in the Snail Helix pomatia L.
W91-07023 5C

Aluminium Phosphatase Activities and Shell-Repair. Studies in the Snail Helix pomatia L.
W91-07024 5C

UPPSALA UNIV. (SWEDEN). NATURGEOGRAFISKA INST.

Resuspension in the Kattegat: Impact of Variation in Wind Climate and Fishery.
W91-06772 2L

USTREDNI USTAV GEOLOGICKY, PRAGUE (CZECHOSLOVAKIA).

Stability of the pH and the Contents of Ammonium and Nitrate in Precipitation Samples.
W91-06880 5B

UTAH STATE UNIV., LOGAN. DEPT. OF FISHERIES AND WILDLIFE.

Role of Refugia in the Recolonization of Streams Devastated by the 1980 Eruption of Mount St. Helens.
W91-06034 2H

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF EXPERIMENTAL ZOOLOGY.

Effect of Cadmium on Protein Synthesis in Gill Tissue of the Sea Mussel Mytilus edulis.
W91-06189 5C

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). ENVIRONMENTAL TOXICOLOGY SECTION.

Dose/Response Study of 2,3,7,8-TCDD in the Rainbow Trout (Salmo gairdneri).
W91-06394 5A

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). RESEARCH GROUP FOR AQUATIC TOXICOLOGY.

Mixed-Function Oxygenase System and Benzo(a)pyrene Metabolism in Echinoderms.
W91-06326 5B

Cadmium Accumulation and Metallothionein-like Proteins in the Sea Star Asterias rubens.
W91-06345 5B

Interference of Polychlorinated Biphenyls (Clophen A50) with Gametogenesis in the Sea Star, Asterias rubens L.
W91-06750 5C

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). RESEARCH INST. OF TOXICOLOGY.

Bioconcentration and Elimination of Triphenyltin Hydroxide in Fish.
W91-06354 5B

VALENCIA UNIV. (SPAIN). FACULTY OF PHYSICS.

Short and Medium Effects on the Environment of Valencia, Spain, of the Chernobyl Nuclear Plant Accident.
W91-05984 5B

VANDKVALITETSINSTITUTET, HOERSHOLM (DENMARK).

Qualitative Importance of the Microbial Loop and Plankton Community Structure in a Eutrophic Lake during a Bloom of Cyanobacteria.
W91-06024 2H

Microbial Degradation of Pentachlorophenol and Lindane in Laboratory-Scale Activated Sludge Reactors.
W91-06077 5D

VERMONT UNIV., BURLINGTON. DEPT. OF BOTANY.

Seasonal Succession of Algal Periphyton from a Wastewater Treatment Facility.
W91-06252 5D

Production and Nutrient Accumulation by Periphyton In a Wastewater Treatment Facility.
W91-06253 5D

VERSAR, INC., COLUMBIA, MD.

Summer Feeding Patterns of White Perch, Channel Catfish, and Yellow Perch in the Susquehanna River, Maryland.
W91-06010 2H

VERSAR, INC., SPRINGFIELD, VA.

Waste Minimization Audits at Industrial and DOD Installations.
W91-06163 5E

Treatment of Spent Solvent Wastewaters: Focus on Changing Economics.
W91-06690 5D

VETERANS ADMINISTRATION WADSWORTH MEDICAL CENTER, LOS ANGELES, CA.

Report of Fluorosis in the United States Secondary to Drinking Well Water.
W91-06958 5C

VILLANOVA UNIV., PA. DEPT. OF BIOLOGY.
Methane Production and Sulfate Reduction in Two Appalachian Peatlands.
W91-06946 2H

VILLANOVA UNIV., PA. DEPT. OF CHEMICAL ENGINEERING.
New Chemical Treatment for Enhanced Phosphorus Removal from Wastewater Using Blends of Aluminum Chloride and Poly-Aluminum Chloride.
W91-06915 5D

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Macrophage Responses of Estuarine Fish as Bioindicators of Toxic Contamination.
W91-06182 5A

Accumulation and Biotransformation of an Organophosphorus Pesticide in Fish and Bivalves.
W91-06333 5B

Some Effects of Sediment-Borne Contaminants on Development and Cytomorphology of Teleost Eye-Lens Epithelial Cells and Their Derivatives.
W91-06376 5C

Secondary Production Within a Seagrass Bed (Zostera marina and Ruppia maritima) in Lower Chesapeake Bay.
W91-06839 2L

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT. DIV. OF CHEMISTRY AND TOXICOLOGY.
Toxicity of Nitrogen-Containing Aromatic Compounds (NCACs): Quinoline and 4-Azafluorene Behavior in an Escherichia coli Test System--Evidence of Membrane Effects.
W91-06705 5C

Reducible Dye 2-(p-Iodophenyl)-3-(p-Nitrophenyl)-5-(Phenyl)-2H-Tetrazolium Chloride (INT) for Use in Aquatic Toxicology: Notes on Chemical Structure, Electrochemistry, and Toxicity.
W91-06706 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. CENTER FOR ENVIRONMENTAL AND HAZARDOUS MATERIAL STUDIES.
Multispecies Toxicity Tests Using Indigenous Organisms: Predicting the Effects of Complex Effluents in Streams.
W91-06780 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
Mitochondrial Response to Chlorophenols as a Short-Term Toxicity Assay.
W91-06995 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. SCHOOL OF FORESTRY.
Source of Increased Stormwaters after Forest Operations.
W91-06561 4C

VIRGINIA POLYTECHNIC INST., BLACKSBURG. DEPT. OF AGRICULTURAL ENGINEERING.
Improving Irrigation Schedules to Increase Returns and Reduce Water Use in Humid Regions.
W91-06118 3F

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.
Porewater Oxidation, Dissolved Phosphate and the Iron Curtain: Iron-Phosphorus Relations in Tidal Freshwater Marshes.
W91-06944 2K

Influence of Tidal Marshes on Upland Groundwater Discharge to Estuaries.
W91-06952 2L

VIZGAZDALKODASI TUDOMANYOS KUTATO INTEZET, BUDAPEST (HUNGARY).
Water Quality and Health (Review of the International Drinking Water Supply and Sanitation Decade).
W91-06064 5F

VRIJE UNIV., AMSTERDAM (NETHERLANDS). DEPT. OF HYDROGEOLOGY AND GEOGRAPHICAL HYDROLOGY.
ETA (Erosion Transport Accumulation) Systems, Their Classification, Mapping and Management.
W91-07100 2J

VRIJE UNIV., AMSTERDAM (NETHERLANDS). DEPT. OF METEOROLOGY.
Composition of Bulk Precipitation on a Coastal Island with Agriculture Compared to an Urban Region.
W91-06877 2B

VYSKUMNY USTAV LESNEHO HOSPODARSTVA, ZVOLEN (CZECHOSLOVAKIA).
Management of Forests with Water Conservation Function.
W91-06554 4A

VYSOKA SKOLA ZEMEDELSKA, BRNO (CZECHOSLOVAKIA). INST. OF FOREST ECOLOGY.
Transpiration of Mature Stands of Spruce (Picea abies (L.) Karst.) as Estimated by the Tree-trunk Heat Balance Method.
W91-06539 2D

WARSAW UNIV. (POLAND). FACULTY OF GEOGRAPHY AND REGIONAL STUDIES.
Application of GIUH and Dimensionless Hydrograph Models to Ungaged Basins.
W91-06482 2E

International Co-operation on Hydrology of the Central and Eastern European Countries.
W91-06498 2E

Extrapolation of Research Results by Deterministic Models.
W91-06566 2A

WASHINGTON COOPERATIVE FISHERY RESEARCH UNIT, SEATTLE.
Effects of Reservoir Enlargement and Other Factors on the Yield of Wild Rainbow and Cutthroat Trout in Spada Lake, Washington.
W91-06029 2H

WASHINGTON STATE UNIV., PULLMAN.
New Models of Hydrological and Stream Channel Relationships.
W91-06624 2E

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Anaerobic Biotransformation of PCE and TCE in Groundwater: A Comparison of Experimental Data with Numerical Results.
W91-06096 5G

WASHINGTON UNIV., SEATTLE. COLL. OF FOREST RESOURCES.
Test of a Surface Runoff and Soil Erosion Model for Forest Road Surfaces.
W91-06606 2J

WASHINGTON UNIV., SEATTLE. DEPT. OF GEOLOGICAL SCIENCES.
Sediment Routing by Debris Flow.
W91-06594 2J

WASHINGTON UNIV., SEATTLE. DEPT. OF GEOPHYSICS.
Initial Motion of Coarse Sediment in Streams of High Gradient.
W91-06617 2J

WASHINGTON UNIV., SEATTLE. FISHERIES RESEARCH INST.
Recovery of Lakes in the 1980 Blast Zone of Mount St. Helens.
W91-06033 2H

Analysis of the Relationship Between a Sand-Dollar Embryo Elutriate Assay and Sediment Contaminants from Stations in an Urban Embayment of Puget Sound, Washington.
W91-06240 5A

Columbia River Estuary Studies: An Introduction to the Estuary, a Brief History, and Prior Studies.
W91-06279 2L

Consumption Processes and Food Web Structure in the Columbia River Estuary.
W91-06287 2L

WASHINGTON UNIV., SEATTLE. GEOPHYSICS PROGRAM.
Circulation, Density Distribution and Neap-Spring Transitions in the Columbia River Estuary.
W91-06281 2L

Energetics and Sedimentary Processes in the Columbia River Estuary.
W91-06283 2L

WASHINGTON UNIV., SEATTLE. SCHOOL OF OCEANOGRAPHY.
Hydrocarbon Bioaccumulation from Contaminated Sediment by the Deposit-Feeding Polychaete Abarenicola pacifica.
W91-06259 5B

Historical Changes in the Columbia River Estuary.
W91-06288 2L

WATER AND ENVIRONMENT RESEARCH INST., HELSINKI (FINLAND).
Preliminary Investigation on Acidification of Ground Water in Finnish Wells.
W91-06097 5C

Frequency Analysis of Flood and Low Flow.
W91-06504 2E

Modelling the Effects of Acid Deposition in a Peaty Catchment in Finland.
W91-06506 5C

WATER AND SANITATION FOR HEALTH PROJECT, ARLINGTON, VA.
Community Self-Financing of Water Supply and Sanitation: What Are the Promises and Pitfalls.
W91-06244 5F

WATERWORKS AUTHORITY, BANGKOK (THAILAND). PLANNING DIV.
Provincial Water Supply in Thailand and the Water Decade.
W91-06063 5F

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF BIOCHEMISTRY.
Characterization of BNF-Inducible Cytochrome P-450IA1 in Cultures of Rainbow Trout Liver Cells.
W91-06338 5C

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF BIOCHEMISTRY.

Morphological Changes in Trout Hepatocytes Exposed to Acetaminophen.
W91-06370 5A

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF MECHANICAL AND AEROSPACE ENGINEERING.
Suspended Sediment-Transport Capacity for Open Channel Flow.
W91-06293 2J

WESTERN WASHINGTON UNIV., BELLINGHAM. DEPT. OF GEOLOGY.
Controls on the Relation of Streamside Landsliding to Channel Sediment Storage in a Region of Active Uplift.
W91-06652 2J

WESTINGHOUSE MATERIALS CO. OF OHIO, CINCINNATI.
Waste Minimization Program at the Feed Materials Production Center.
W91-06160 5E

WILFRID LAURIER UNIV., WATERLOO (ONTARIO). DEPT. OF BIOLOGY.
Determining the Health of Fish Communities: Parallels with Human Medicine.
W91-06929 5A

WINAND STARING CENTRE FOR INTEGRATED LAND, SOIL AND WATER RESEARCH, WAGENINGEN (NETHERLANDS).
Modelling Agriculture to Support Regional Water Management.
W91-06791 6D

Shrinkage of Dutch Clay Soil Aggregates.
W91-06935 2G

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON. WATER RESOURCES RESEARCH SECTION.
Influence of Sediment and Groundwater on the Distribution and Biomass of Myriophyllum spicatum L. in Devil's Lake, Wisconsin.
W91-06012 2H

WISCONSIN UNIV.-EAU CLAIRE.
Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions.
W91-06855 5B

WISCONSIN UNIV.-MADISON. DEPT. OF AGRONOMY.
Biodegradation of Butylate, EPTC, and Extenders in Previously Treated Soils.
W91-06987 5B

WISCONSIN UNIV.-MADISON. INST. FOR ENVIRONMENTAL STUDIES.
Exceptional Waters Approach--A Focus for Coordinated Natural Resources Management.
W91-06027 6B

WISCONSIN UNIV.-MADISON. LAB. OF HYGIENE.
Polychlorinated Biphenyl Congeners in Blood of Wisconsin Sport Fish Consumers.
W91-06775 5B

WISCONSIN UNIV.-MILWAUKEE. DEPT. OF CHEMISTRY.
Metal-Binding Proteins and Peptides for the Detection of Heavy Metals in Aquatic Organisms.
W91-06186 5A

WISCONSIN UNIV.-STEVENS POINT. COLL. OF NATURAL RESOURCES.
Soil Type, Precipitation, and Fertilizer N Effects on Corn Yields.
W91-06302 3F

Productivity, Diet, and Environmental Contaminants in Bald Eagles Nesting Near the Wisconsin Shoreline of Lake Superior.
W91-06774 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Biological Effects of Petroleum Hydrocarbons: Predictions of Long-term Effects and Recovery.
W91-06031 5C

Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in Mytilus edulis L.
W91-06360 5B

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA. DEPT. OF BIOLOGY.
Polychlorinated Biphenyls Concentration and Cytochrome P-450E Expression in Winter Flounder from Contaminated Environments.
W91-06327 5B

Induction of Cytochrome P-450E (P-450IA1) by 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) in the Marine Fish Scup (Stenotomus chrysops).
W91-06332 5C

Cellular Alterations Preceding Neoplasia in Pseudopleuronectes americanus from Boston Harbor.
W91-06380 5C

Cellular Distribution of Cytochrome P-450E in Winter Flounder Liver with Degenerative and Neoplastic Disease.
W91-06383 5C

WORLD HEALTH ORGANIZATION, GENEVA (SWITZERLAND). DIV. OF ENVIRONMENTAL HEALTH.
Water Quality and Health.
W91-06060 5C

Beyond the Decade: A Global Framework for Global Cooperation.
W91-06061 5G

WORLD HEALTH ORGANIZATION, GENEVA (SWIZTZERLAND). COMMUNITY WATER SUPPLY AND SANITATION UNIT.
Chadwick Centenary Lecture--A Review of Two Centuries of Public Health.
W91-05975 5G

WRIGHT STATE UNIV., DAYTON, OH. DEPT. OF CHEMISTRY.
Dechlorination of Organic Compounds Contained in Hazardous Wastes.
W91-06669 5D

WYOMING UNIV., LARAMIE. DEPT. OF AGRICULTURAL ECONOMICS.
Evaluating Water Supply Outlook for Fertilizing Hay under Variable Streamflows.
W91-06301 3F

XIAMEN UNIV. (CHINA). DEPT. OF OCEANOGRAPHY.
Preliminary Study on the Distribution of Nutrients, Organic Matter, Trace Metals in Sea Surface Microlayer in Xiamen Bay and Jiulong Estuary.
W91-06100 2L

Phosphate Limitation of Phytoplankton Growth in the Changjiang Estuary.
W91-06105 5C

Se Uptake and Accumulation in Marine Phytoplankton and Transfer of Se to the Clam Puditapes philippnarum.
W91-06262 5B

XIAMEN UNIV. (CHINA). INST. OF ENVIRONMENTAL SCIENCE.
Fertility of Domestic Sewage and Eutrophication in Estuarine Harbor.
W91-06221 5C

YAMAGUCHI UNIV. (JAPAN). DEPT. OF CIVIL ENGINEERING.
Systematic Pollutegraph Simulation for Real Scale River Basin.
W91-06054 5B

YELLOW RIVER CONSERVANCY COMMISSION, ZHENGZHOU (CHINA). INST. OF HYDRAULIC RESEARCH.
Study of the Total Load Transport by the Yellow River.
W91-07108 2J

YELLOW RIVER WATER RESOURCE PROTECTION INST., ZHENGZHOU (CHINA).
Analysis of Sediment Yields during the Historic Period in the Loess Region of the Yellow River Basin.
W91-07098 2J

YORKSHIRE WATER AUTHORITY (ENGLAND). WESTERN DIV.
Network Management--the Bradford Experience.
W91-05967 5F

ZENON WATER SYSTEMS, INC., BURLINGTON (ONTARIO).
Optimizing Polymer Consumption in Sludge Dewatering Applications.
W91-06424 5D

ZHEJIANG UNIV., HANGZHOU (CHINA). DEPT. OF CHEMICAL ENGINEERING.
Selective Removal of Metals from Wastewater Using Affinity Dialysis.
W91-06667 5D

ZIMBABWE UNIV., HARARE. DEPT. OF BIOLOGICAL SCIENCES.
Inshore Fish Yield Potential of Lake Kariba, Zimbabwe.
W91-06745 2H

ZORC, RISSETO AND AND WEAVER, WASHINGTON, DC.
Minimizing Municipal Liability Under New Federal Pretreatment Regulations.
W91-06912 5D

ACCESSION NUMBER INDEX

W91-05959 2H
W91-05960 5F
W91-05961 5F
W91-05962 5F
W91-05963 5F
W91-05964 5F
W91-05965 5F
W91-05966 3F
W91-05967 5F
W91-05968 5D
W91-05969 5E
W91-05970 5G
W91-05971 4A
W91-05972 5A
W91-05973 5D
W91-05974 5G
W91-05975 5G
W91-05976 5F
W91-05977 5F
W91-05978 2G
W91-05979 2G
W91-05980 2G
W91-05981 2D
W91-05982 5F
W91-05983 5B
W91-05984 5B
W91-05985 5A
W91-05986 5A
W91-05987 5B
W91-05988 5C
W91-05989 5C
W91-05990 5C
W91-05991 5C
W91-05992 5D
W91-05993 5F
W91-05994 5B
W91-05995 5F
W91-05996 5C
W91-05997 5B
W91-05998 5C
W91-05999 5B
W91-06000 5C
W91-06001 5C
W91-06002 5A
W91-06003 5B
W91-06004 5D
W91-06005 5A
W91-06006 5B
W91-06007 5A
W91-06008 6G
W91-06009 2H
W91-06010 2H
W91-06011 2H
W91-06012 2H
W91-06013 2H
W91-06014 2H
W91-06015 4A
W91-06016 2H
W91-06017 2H
W91-06018 2H
W91-06019 2H
W91-06020 5B
W91-06021 5B
W91-06022 2H
W91-06023 5B
W91-06024 2H
W91-06025 2H
W91-06026 2E
W91-06027 6B
W91-06028 8I
W91-06029 2H
W91-06030 8I
W91-06031 5C
W91-06032 2L
W91-06033 2H
W91-06034 2H
W91-06035 2H
W91-06036 2H
W91-06037 2H
W91-06038 2L
W91-06039 5G
W91-06040 6D
W91-06041 5G
W91-06042 5G
W91-06043 5G
W91-06044 6E
W91-06045 6E
W91-06046 5G
W91-06047 5G
W91-06048 5G
W91-06049 6D
W91-06050 5G
W91-06051 5G
W91-06052 5G
W91-06053 5B
W91-06054 5B
W91-06055 5B
W91-06056 5C
W91-06057 5B
W91-06058 5C
W91-06059 5B
W91-06060 5C
W91-06061 5G
W91-06062 6E
W91-06063 5F
W91-06064 5F
W91-06065 5F
W91-06066 5A
W91-06067 5A
W91-06068 5D
W91-06069 5D
W91-06070 5B
W91-06071 5B
W91-06072 5F
W91-06073 5D
W91-06074 5G
W91-06075 5B
W91-06076 5D
W91-06077 5D
W91-06078 5D
W91-06079 5D
W91-06080 5F
W91-06081 5D
W91-06082 5E
W91-06083 5G
W91-06084 5D
W91-06085 5B
W91-06086 5B
W91-06087 5B
W91-06088 5B
W91-06089 5G
W91-06090 5B
W91-06091 5G
W91-06092 5C
W91-06093 5B
W91-06094 5A
W91-06095 5B
W91-06096 5G
W91-06097 5C
W91-06098 7B
W91-06099 2L
W91-06100 2L
W91-06101 2L
W91-06102 5C
W91-06103 5C
W91-06104 5B
W91-06105 5C
W91-06106 2L
W91-06107 5G
W91-06108 3F
W91-06109 5G
W91-06110 2B
W91-06111 7B
W91-06112 7B
W91-06113 2B
W91-06114 3F
W91-06115 7C
W91-06116 6C
W91-06117 4D
W91-06118 3F
W91-06119 6D
W91-06120 5G
W91-06121 5F
W91-06122 5G
W91-06123 5D
W91-06124 5E
W91-06125 5D
W91-06126 5E
W91-06127 5E
W91-06128 5E
W91-06129 5E
W91-06130 5E
W91-06131 5E
W91-06132 5E
W91-06133 5E
W91-06134 5E
W91-06135 5E
W91-06136 5E
W91-06137 5E
W91-06138 5E
W91-06139 5E
W91-06140 7B
W91-06141 5E
W91-06142 5E
W91-06143 5E
W91-06144 5E
W91-06145 5B
W91-06146 5E
W91-06147 5E
W91-06148 5E
W91-06149 5E
W91-06150 5E
W91-06151 5B
W91-06152 5E
W91-06153 5E
W91-06154 5E
W91-06155 5E
W91-06156 5E
W91-06157 5E
W91-06158 5E
W91-06159 5D
W91-06160 5E
W91-06161 5E
W91-06162 5E
W91-06163 5E
W91-06164 5E
W91-06165 5E
W91-06166 5E
W91-06167 5D
W91-06168 5E
W91-06169 5D
W91-06170 5E
W91-06171 5D
W91-06172 5E
W91-06173 5D
W91-06174 5D
W91-06175 5E
W91-06176 5A
W91-06177 5A
W91-06178 5A
W91-06179 5A
W91-06180 5C
W91-06181 5A
W91-06182 5A
W91-06183 5A
W91-06184 5C
W91-06185 5C
W91-06186 5A
W91-06187 5A
W91-06188 5A
W91-06189 5C
W91-06190 5A
W91-06191 5A
W91-06192 5C
W91-06193 5A
W91-06194 5F
W91-06195 5F
W91-06196 5F
W91-06197 5F
W91-06198 5F
W91-06199 5F
W91-06200 5F
W91-06201 5F
W91-06202 5F
W91-06203 5F
W91-06204 5F
W91-06205 5F
W91-06206 5F
W91-06207 5F
W91-06208 5F
W91-06209 5F
W91-06210 5A
W91-06211 5F
W91-06212 5F
W91-06213 5F
W91-06214 5A
W91-06215 5A
W91-06216 5A
W91-06217 5A
W91-06218 2L
W91-06219 2J
W91-06220 5B
W91-06221 5C
W91-06222 5D
W91-06223 5D
W91-06224 5D
W91-06225 5D
W91-06226 5E
W91-06227 6B
W91-06228 5E
W91-06229 5G
W91-06230 6E
W91-06231 2J
W91-06232 2J
W91-06233 2J
W91-06234 2J
W91-06235 2B
W91-06236 5B
W91-06237 5F
W91-06238 5B
W91-06239 5C
W91-06240 5A
W91-06241 5B
W91-06242 5B
W91-06243 5B
W91-06244 5F
W91-06245 5D
W91-06246 2H
W91-06247 2H
W91-06248 2H
W91-06249 5C
W91-06250 2H
W91-06251 2H
W91-06252 5D
W91-06253 5D
W91-06254 2E
W91-06255 2E
W91-06256 5C
W91-06257 2H
W91-06258 5C
W91-06259 5B
W91-06260 5A
W91-06261 5C
W91-06262 5B
W91-06263 2K
W91-06264 5C
W91-06265 5C
W91-06266 5G
W91-06267 2J
W91-06268 5C
W91-06269 5A
W91-06270 2H
W91-06271 2H
W91-06272 2J
W91-06273 4D
W91-06274 6E
W91-06275 4C
W91-06276 3F
W91-06277 4D
W91-06278 2H
W91-06279 2L
W91-06280 2L
W91-06281 2L
W91-06282 2L
W91-06283 2L
W91-06284 2L
W91-06285 2L
W91-06286 2L
W91-06287 2L
W91-06288 2L
W91-06289 2L
W91-06290 2J
W91-06291 2E
W91-06292 8B
W91-06293 2J

W91-06294 8B
W91-06295 8G
W91-06296 8A
W91-06297 8B
W91-06298 5B
W91-06299 5E
W91-06300 2G
W91-06301 3F
W91-06302 3F
W91-06303 3F
W91-06304 5G
W91-06305 5G
W91-06306 5G
W91-06307 2G
W91-06308 5B
W91-06309 5C
W91-06310 5C
W91-06311 3F
W91-06312 2B
W91-06313 3F
W91-06314 2I
W91-06315 3F
W91-06316 5B
W91-06317 5B
W91-06318 2I
W91-06319 2I
W91-06320 5B
W91-06321 2H
W91-06322 2H
W91-06323 5B
W91-06324 5B
W91-06325 5B
W91-06326 5B
W91-06327 5B
W91-06328 5B
W91-06329 5C
W91-06330 5C
W91-06331 5C
W91-06332 5C
W91-06333 5B
W91-06334 5C
W91-06335 5C
W91-06336 5B
W91-06337 5C
W91-06338 5C
W91-06339 5C
W91-06340 5C
W91-06341 5A
W91-06342 5C
W91-06343 5C
W91-06344 5C
W91-06345 5B
W91-06346 5B
W91-06347 5C
W91-06348 5B
W91-06349 5A
W91-06350 5B
W91-06351 5B
W91-06352 5B
W91-06353 5B
W91-06354 5B
W91-06355 5C
W91-06356 5B
W91-06357 5C
W91-06358 5B
W91-06359 5C
W91-06360 5B
W91-06361 5B
W91-06362 5C
W91-06363 5B
W91-06364 5C
W91-06365 5C
W91-06366 5C
W91-06367 5B
W91-06368 5C
W91-06369 5A
W91-06370 5A
W91-06371 5C
W91-06372 5C
W91-06373 5C
W91-06374 5C
W91-06375 5C
W91-06376 5C
W91-06377 5A
W91-06378 5C
W91-06379 5C
W91-06380 5C
W91-06381 5C
W91-06382 5A
W91-06383 5C
W91-06384 5B
W91-06385 5A
W91-06386 5C
W91-06387 5C
W91-06388 5B
W91-06389 5B
W91-06390 5C
W91-06391 5B
W91-06392 5C
W91-06393 5C
W91-06394 5A
W91-06395 5C
W91-06396 5C
W91-06397 5B
W91-06398 3F
W91-06399 2G
W91-06400 2D
W91-06401 3F
W91-06402 3F
W91-06403 3F
W91-06404 2B
W91-06405 8D
W91-06406 4C
W91-06407 2G
W91-06408 5B
W91-06409 3F
W91-06410 2B
W91-06411 2J
W91-06412 2C
W91-06413 7B
W91-06414 3F
W91-06415 2G
W91-06416 5C
W91-06417 3F
W91-06418 3F
W91-06419 2D
W91-06420 3F
W91-06421 5D
W91-06422 5D
W91-06423 5D
W91-06424 5D
W91-06425 5D
W91-06426 5D
W91-06427 5D
W91-06428 5D
W91-06429 5D
W91-06430 5D
W91-06431 5D
W91-06432 5D
W91-06433 5D
W91-06434 5D
W91-06435 5E
W91-06436 5D
W91-06437 5D
W91-06438 5D
W91-06439 5D
W91-06440 5D
W91-06441 5D
W91-06442 5D
W91-06443 5D
W91-06444 5G
W91-06445 5G
W91-06446 5G
W91-06447 5G
W91-06448 5B
W91-06449 5B
W91-06450 5E
W91-06451 5E
W91-06452 5E
W91-06453 5D
W91-06454 5D
W91-06455 5D
W91-06456 5D
W91-06457 5D
W91-06458 5D
W91-06459 5D
W91-06460 5D
W91-06461 2E
W91-06462 2E
W91-06463 2E
W91-06464 2E
W91-06465 2C
W91-06466 2E
W91-06467 2E
W91-06468 2E
W91-06469 2E
W91-06470 2E
W91-06471 2E
W91-06472 2E
W91-06473 2E
W91-06474 2E
W91-06475 2E
W91-06476 2E
W91-06477 2E
W91-06478 2E
W91-06479 2E
W91-06480 2E
W91-06481 2E
W91-06482 2E
W91-06483 2E
W91-06484 2E
W91-06485 2E
W91-06486 2E
W91-06487 2A
W91-06488 2F
W91-06489 2E
W91-06490 2E
W91-06491 2E
W91-06492 2E
W91-06493 2E
W91-06494 4C
W91-06495 4C
W91-06496 2E
W91-06497 2E
W91-06498 2E
W91-06499 7A
W91-06500 4C
W91-06501 2B
W91-06502 2E
W91-06503 2E
W91-06504 2E
W91-06505 2E
W91-06506 5C
W91-06507 4C
W91-06508 2E
W91-06509 2E
W91-06510 4C
W91-06511 5B
W91-06512 5B
W91-06513 5B
W91-06514 5B
W91-06515 5B
W91-06516 5B
W91-06517 5B
W91-06518 5B
W91-06519 5B
W91-06520 5B
W91-06521 4C
W91-06522 2B
W91-06523 2J
W91-06524 2J
W91-06525 4D
W91-06526 4C
W91-06527 2J
W91-06528 2F
W91-06529 2E
W91-06530 4A
W91-06531 4A
W91-06532 4A
W91-06533 4C
W91-06534 4A
W91-06535 2C
W91-06536 4A
W91-06537 4A
W91-06538 2E
W91-06539 2D
W91-06540 2D
W91-06541 2D
W91-06542 2I
W91-06543 2D
W91-06544 2D
W91-06545 2D
W91-06546 2G
W91-06547 2G
W91-06548 2K
W91-06549 2G
W91-06550 4C
W91-06551 5B
W91-06552 5C
W91-06553 4C
W91-06554 4A
W91-06555 4A
W91-06556 4A
W91-06557 4C
W91-06558 4C
W91-06559 2E
W91-06560 4C
W91-06561 4C
W91-06562 4C
W91-06563 4C
W91-06564 4C
W91-06565 4C
W91-06566 2A
W91-06567 2J
W91-06568 2E
W91-06569 6A
W91-06570 2J
W91-06571 2J
W91-06572 4D
W91-06573 2J
W91-06574 2J
W91-06575 2J
W91-06576 2E
W91-06577 2J
W91-06578 2J
W91-06579 2J
W91-06580 2J
W91-06581 2J
W91-06582 2J
W91-06583 2J
W91-06584 2J
W91-06585 2J
W91-06586 2J
W91-06587 2J
W91-06588 2J
W91-06589 2J
W91-06590 2J
W91-06591 2J
W91-06592 2J
W91-06593 2J
W91-06594 2J
W91-06595 2J
W91-06596 2J
W91-06597 2J
W91-06598 2B
W91-06599 4C
W91-06600 2J
W91-06601 2J
W91-06602 2J
W91-06603 2J
W91-06604 2J
W91-06605 2J
W91-06606 2J
W91-06607 2J
W91-06608 2J
W91-06609 2J
W91-06610 2J
W91-06611 2J
W91-06612 2J
W91-06613 2E
W91-06614 2J
W91-06615 2J
W91-06616 2E
W91-06617 2J
W91-06618 2J
W91-06619 2J
W91-06620 2J
W91-06621 4C
W91-06622 2J
W91-06623 2J
W91-06624 2E
W91-06625 2J
W91-06626 2J
W91-06627 2J
W91-06628 4C

W91-06629 2J
W91-06630 7C
W91-06631 2J
W91-06632 2E
W91-06633 2J
W91-06634 2J
W91-06635 2J
W91-06636 2E
W91-06637 8I
W91-06638 2J
W91-06639 2J
W91-06640 2E
W91-06641 2J
W91-06642 2J
W91-06643 2E
W91-06644 4C
W91-06645 2J
W91-06646 2J
W91-06647 2J
W91-06648 2J
W91-06649 2J
W91-06650 2J
W91-06651 2J
W91-06652 2J
W91-06653 7B
W91-06654 7B
W91-06655 5G
W91-06656 5D
W91-06657 5D
W91-06658 5D
W91-06659 5D
W91-06660 5D
W91-06661 5D
W91-06662 5D
W91-06663 5G
W91-06664 5D
W91-06665 5D
W91-06666 5D
W91-06667 5D
W91-06668 5D
W91-06669 5D
W91-06670 5G
W91-06671 5E
W91-06672 5E
W91-06673 5D
W91-06674 5E
W91-06675 5D
W91-06676 5D
W91-06677 5D
W91-06678 5D
W91-06679 5E
W91-06680 5G
W91-06681 5G
W91-06682 5E
W91-06683 5E
W91-06684 5G
W91-06685 5D
W91-06686 5D
W91-06687 5D
W91-06688 5D
W91-06689 5D
W91-06690 5D
W91-06691 5C
W91-06692 5C
W91-06693 5C
W91-06694 5B
W91-06695 5C
W91-06696 5B
W91-06697 5B
W91-06698 5A
W91-06699 5A
W91-06700 5A
W91-06701 5C
W91-06702 5A
W91-06703 5C
W91-06704 5C
W91-06705 5C
W91-06706 5C
W91-06707 5C
W91-06708 5C
W91-06709 5C
W91-06710 5C
W91-06711 5C
W91-06712 5C
W91-06713 5C
W91-06714 5C
W91-06715 5C
W91-06716 4C
W91-06717 2J
W91-06718 2E
W91-06719 2J
W91-06720 2J
W91-06721 2J
W91-06722 2J
W91-06723 2E
W91-06724 2E
W91-06725 2J
W91-06726 2J
W91-06727 2J
W91-06728 2E
W91-06729 7B
W91-06730 2J
W91-06731 3F
W91-06732 5B
W91-06733 5B
W91-06734 5B
W91-06735 5B
W91-06736 5B
W91-06737 3F
W91-06738 3F
W91-06739 3F
W91-06740 3F
W91-06741 3F
W91-06742 3F
W91-06743 2F
W91-06744 5B
W91-06745 2H
W91-06746 5B
W91-06747 5B
W91-06748 5B
W91-06749 5C
W91-06750 5C
W91-06751 2H
W91-06752 2H
W91-06753 7B
W91-06754 2H
W91-06755 2L
W91-06756 2H
W91-06757 2L
W91-06758 2L
W91-06759 2J
W91-06760 2H
W91-06761 2H
W91-06762 5C
W91-06763 2H
W91-06764 5B
W91-06765 2L
W91-06766 2L
W91-06767 2L
W91-06768 2L
W91-06769 2L
W91-06770 5B
W91-06771 2L
W91-06772 2L
W91-06773 5C
W91-06774 5C
W91-06775 5B
W91-06776 5C
W91-06777 5C
W91-06778 5B
W91-06779 5C
W91-06780 5C
W91-06781 5C
W91-06782 5C
W91-06783 5B
W91-06784 5C
W91-06785 5C
W91-06786 2K
W91-06787 2G
W91-06788 5E
W91-06789 2G
W91-06790 5C
W91-06791 6D
W91-06792 5B
W91-06793 5A
W91-06794 5B
W91-06795 5B
W91-06796 5G
W91-06797 5B
W91-06798 2F
W91-06799 5D
W91-06800 2J
W91-06801 5B
W91-06802 5C
W91-06803 5B
W91-06804 5C
W91-06805 5B
W91-06806 2K
W91-06807 5B
W91-06808 3A
W91-06809 3A
W91-06810 5F
W91-06811 5F
W91-06812 5F
W91-06813 5F
W91-06814 5F
W91-06815 2L
W91-06816 2L
W91-06817 2L
W91-06818 5B
W91-06819 2K
W91-06820 2K
W91-06821 2L
W91-06822 5A
W91-06823 5D
W91-06824 2H
W91-06825 5D
W91-06826 4A
W91-06827 5A
W91-06828 5B
W91-06829 7B
W91-06830 5B
W91-06831 6B
W91-06832 2L
W91-06833 2L
W91-06834 2L
W91-06835 2J
W91-06836 2J
W91-06837 2L
W91-06838 2L
W91-06839 2L
W91-06840 2L
W91-06841 2L
W91-06842 2L
W91-06843 2L
W91-06844 2L
W91-06845 2L
W91-06846 2H
W91-06847 5D
W91-06848 6A
W91-06849 5B
W91-06850 8G
W91-06851 5G
W91-06852 5G
W91-06853 7B
W91-06854 5B
W91-06855 5B
W91-06856 5B
W91-06857 5D
W91-06858 5D
W91-06859 5B
W91-06860 5D
W91-06861 5B
W91-06862 3C
W91-06863 5F
W91-06864 5D
W91-06865 5D
W91-06866 5D
W91-06867 5B
W91-06868 5D
W91-06869 5G
W91-06870 5B
W91-06871 5C
W91-06872 5D
W91-06873 5C
W91-06874 5C
W91-06875 5B
W91-06876 2B
W91-06877 2B
W91-06878 5B
W91-06879 5B
W91-06880 5B
W91-06881 2K
W91-06882 5C
W91-06883 5B
W91-06884 5C
W91-06885 5C
W91-06886 5C
W91-06887 5C
W91-06888 5C
W91-06889 5C
W91-06890 5C
W91-06891 5C
W91-06892 5C
W91-06893 5B
W91-06894 5B
W91-06895 5B
W91-06896 5A
W91-06897 5D
W91-06898 5F
W91-06899 5G
W91-06900 2F
W91-06901 2F
W91-06902 6B
W91-06903 6G
W91-06904 2E
W91-06905 2L
W91-06906 2G
W91-06907 2J
W91-06908 2E
W91-06909 2K
W91-06910 5C
W91-06911 5C
W91-06912 5D
W91-06913 5G
W91-06914 5D
W91-06915 5D
W91-06916 5C
W91-06917 7C
W91-06918 3F
W91-06919 5A
W91-06920 5A
W91-06921 5A
W91-06922 5A
W91-06923 5A
W91-06924 5A
W91-06925 5G
W91-06926 5A
W91-06927 5A
W91-06928 5A
W91-06929 5A
W91-06930 5A
W91-06931 5A
W91-06932 3F
W91-06933 2I
W91-06934 3F
W91-06935 2G
W91-06936 5B
W91-06937 2G
W91-06938 5B
W91-06939 2L
W91-06940 2L
W91-06941 2I
W91-06942 2I
W91-06943 5B
W91-06944 2K
W91-06945 4C
W91-06946 2H
W91-06947 2H
W91-06948 2G
W91-06949 5C
W91-06950 5B
W91-06951 2F
W91-06952 2L
W91-06953 5B
W91-06954 2F
W91-06955 2F
W91-06956 5B
W91-06957 5B
W91-06958 5C
W91-06959 5B
W91-06960 5A
W91-06961 2G
W91-06962 5C
W91-06963 2G

W91-06964 5C
W91-06965 2K
W91-06966 2G
W91-06967 3F
W91-06968 2K
W91-06969 2K
W91-06970 5A
W91-06971 5E
W91-06972 2K
W91-06973 5B
W91-06974 3F
W91-06975 2K
W91-06976 2K
W91-06977 2K
W91-06978 5E
W91-06979 2K
W91-06980 3F
W91-06981 3F
W91-06982 5B
W91-06983 5B
W91-06984 5B
W91-06985 5B
W91-06986 5B
W91-06987 5B
W91-06988 5B
W91-06989 5B
W91-06990 5A
W91-06991 5B
W91-06992 5B
W91-06993 5C
W91-06994 5A
W91-06995 5C
W91-06996 5A
W91-06997 5C
W91-06998 5C
W91-06999 5C
W91-07000 5C
W91-07001 5A
W91-07002 5B
W91-07003 5C
W91-07004 5C
W91-07005 5C
W91-07006 5C
W91-07007 5B
W91-07008 2E
W91-07009 6G
W91-07010 6G
W91-07011 7B
W91-07012 5A
W91-07013 5A
W91-07014 5A
W91-07015 5A
W91-07016 5A
W91-07017 5A
W91-07018 5C
W91-07019 5B
W91-07020 5B
W91-07021 5B
W91-07022 5B
W91-07023 5C
W91-07024 5C
W91-07025 5C
W91-07026 2J
W91-07027 8B
W91-07028 8B
W91-07029 5B
W91-07030 5B
W91-07031 2J
W91-07032 8B
W91-07033 5D
W91-07034 2E
W91-07035 2K
W91-07036 5G
W91-07037 2F
W91-07038 6G
W91-07039 6G
W91-07040 5B
W91-07041 2J
W91-07042 2E
W91-07043 5G
W91-07044 2F
W91-07045 2J
W91-07046 6G
W91-07047 2F
W91-07048 5B
W91-07049 3C
W91-07050 2F
W91-07051 5G
W91-07052 7B
W91-07053 2F
W91-07054 5G
W91-07055 5G
W91-07056 5G
W91-07057 2J
W91-07058 2J
W91-07059 2J
W91-07060 2J
W91-07061 2J
W91-07062 2J
W91-07063 2J
W91-07064 2J
W91-07065 2J
W91-07066 4D
W91-07067 2J
W91-07068 2J
W91-07069 2J
W91-07070 2J
W91-07071 2J
W91-07072 2J
W91-07073 2J
W91-07074 2J
W91-07075 2J
W91-07076 2J
W91-07077 2J
W91-07078 2J
W91-07079 2J
W91-07080 2J
W91-07081 2J
W91-07082 2J
W91-07083 2J
W91-07084 2J
W91-07085 2J
W91-07086 2J
W91-07087 2J
W91-07088 2J
W91-07089 2J
W91-07090 2J
W91-07091 2J
W91-07092 2J
W91-07093 2J
W91-07094 2J
W91-07095 2J
W91-07096 2J
W91-07097 2J
W91-07098 2J
W91-07099 2J
W91-07100 2J
W91-07101 2J
W91-07102 2J
W91-07103 2J
W91-07104 2J
W91-07105 2J
W91-07106 2J
W91-07107 2J
W91-07108 2J
W91-07109 2J
W91-07110 2J
W91-07111 2J
W91-07112 2J
W91-07113 2J
W91-07114 2J
W91-07115 2J
W91-07116 2J
W91-07117 2J

*U.S. G.P.O.:1991-281-553:20014

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

1991 Price Schedules for the United States, Canada, and Mexico

These prices are for customers in the United States, Canada, and Mexico; other customers, write for price list PR-360-4.

Microfiche & Paper Copy Reports

Standard Prices		*Exception Prices*	
A01	$8.00	E01	$10.00
A02	11.00	E02	12.00
A03	15.00	E03	14.00
A04–A05	17.00	E04	16.50
A06–A09	23.00	E05	18.50
A10–A13	31.00	E06	21.50
A14–A17	39.00	E07	24.00
A18–A21	45.00	E08	27.00
A22–A25	53.00	E09	29.50
A99	*	E10	32.50
		E11	35.00
"N" Codes		E12	38.50
		E13	41.00
N01	$60.00	E14	45.00
N02	59.00	E15	48.50
N03	20.00	E16	53.00
		E17	57.50
		E18	62.00
		E19	69.00
		E20	80.00
		E99	*

Computer Products

Diskettes		*Magnetic Tapes*	
D01	$50	T01	$165
D02	80	T02	220
D03	130	T03	340
D04	180	T04	450
D05	230	T05	560
D06	280	T06	670
D07	330	T07	780
D08	380	T08	890
D09	430	T09	1,000
D10	480	T10	1,110
D11	530	T11	1,220
D12	580	T12	1,330
D13	630	T13	1,440
D14	680	T14	1,550
D15	730	T15	1,660
D16	780	T16	1,770
D17	830	T17	1,880
D18	880	T18	1,990
D19	930	T19	2,100
D99	*	T99	*

* Contact NTIS for price

Prices effective January 1, 1991

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OFFICIAL BUSINESS

Penalty for Private Use, $300

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S DEPARTMENT OF COMMERCE
COM-211

Special Fourth Class Rate Book

024002
UNIV MICROFILM INTL
300 ZEEB RD
ANN ARBOR MI 48106